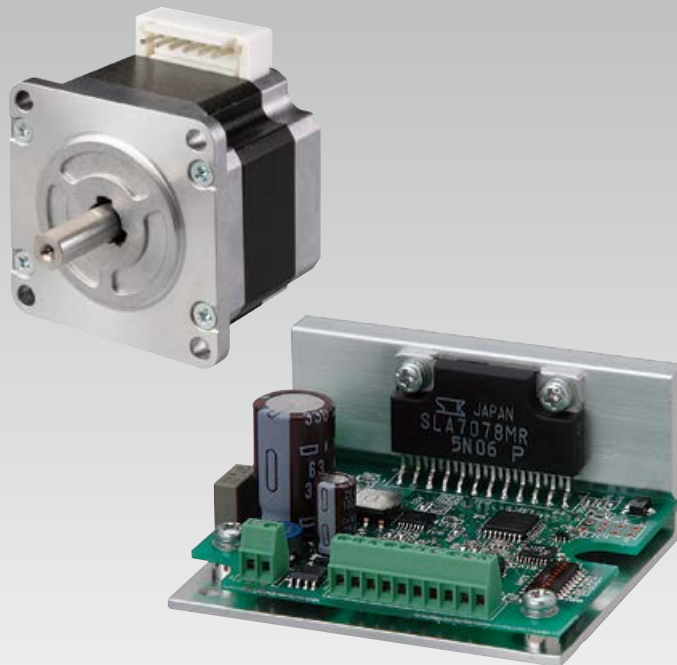


# SANMOTION

STEPPING SYSTEMS

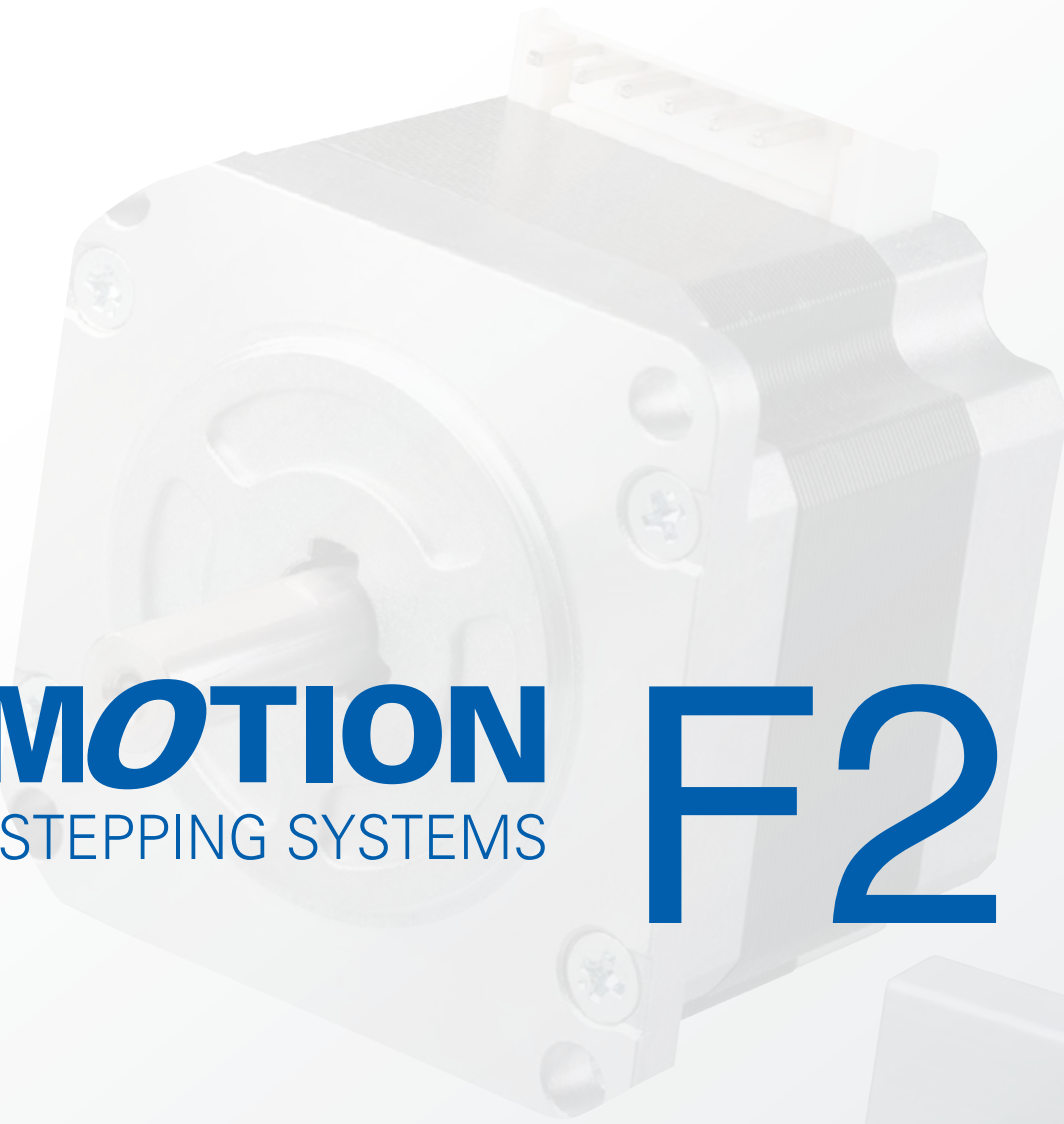
# F2

2-Phase Stepping Systems



**SANYO DENKI**

Ver.9



# SANMOTION

2-PHASE STEPPING SYSTEMS

# F2



DC Input Set Orders

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DC Input Stepping Drivers

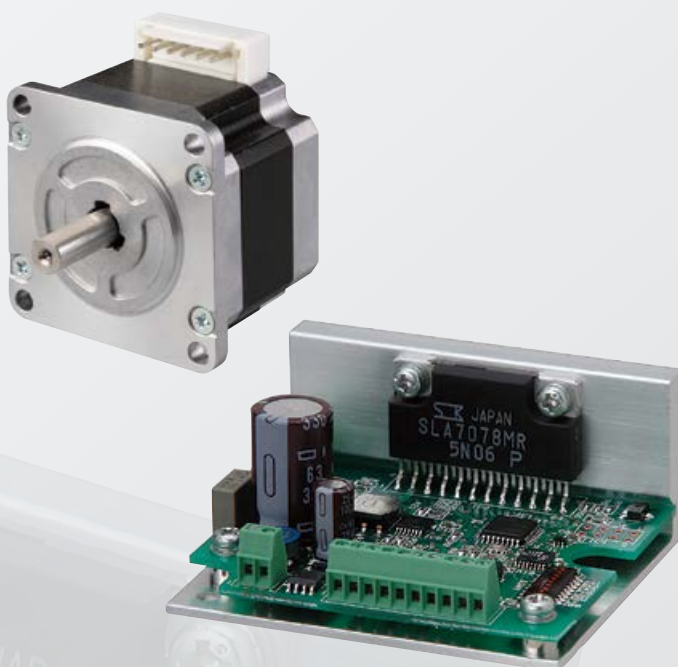
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Stepping Motors

---

Stepping Motors, IP65-Rated Stepping Motors,  
In-Vacuum Stepping Motors, Synchronous Motors



## Contents

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| Application Examples ..... | p. 4 |
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## Set Orders

|                                                 |       |
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## Stepping Motors (Single Items)

|                                                             |       |
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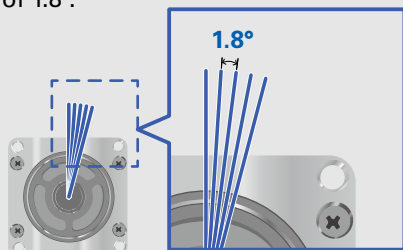
## Easy positioning control

by simple encoder-less stepping systems



Stepping motors rotate precisely at a fixed angle (step angle) with each pulse the driver receives from a pulse generator.

SANMOTION F2 motors typically have a full step angle of 1.8°.



Full step angle  
**1.8°**

**200  
steps**

These use open-loop control without an encoder (position detection sensor), helping build simple and low-cost systems. Ease of use is a key point.

In addition, they use holding force when stopped, and feature stable stopping without micro vibrations.



## Application Examples

The SANMOTION F2 can be used in a wide variety of applications, including fixed-speed drive synchronized with command pulses, accurate positioning, and stable stopping.



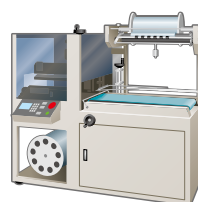
ATM



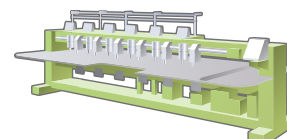
Blood analyzer



Wafer cleaning equipment



Food packaging equipment



Embroidery machine

We hereby declare that the products listed in the catalog comply with the threshold values listed in Annex II, Directive (EU) 2015/863, which is an amendment to Directive 2011/65/EU of the European Parliament and of the Council of June 8, 2011 on the restriction of the use of certain hazardous substances (RoHS) in electrical and electronic equipment. However, the applications listed in ANNEX III of RoHS Directive 2011/65/EU are exempted from the restriction. Also, all models of SANMOTION F2 drivers conform to CE/EN and UL as standard.

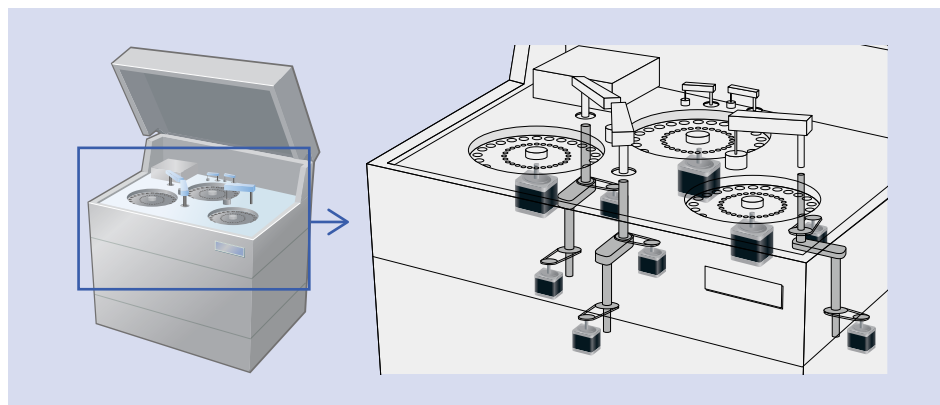




# Application Examples

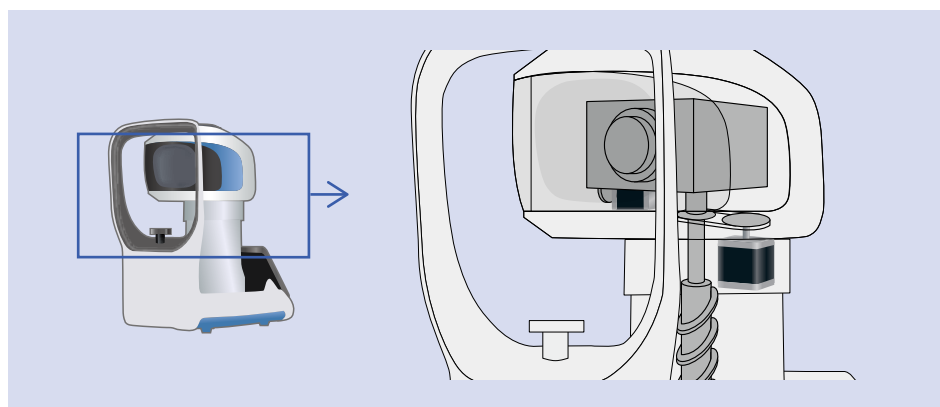
## Blood analyzer

For rotating the specimen tray and rotary table



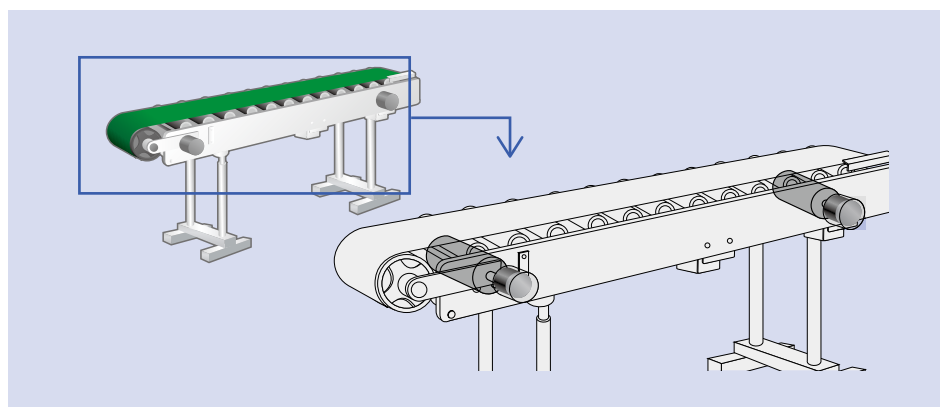
## Ophthalmology inspection equipment

For moving the camera vertically and horizontally



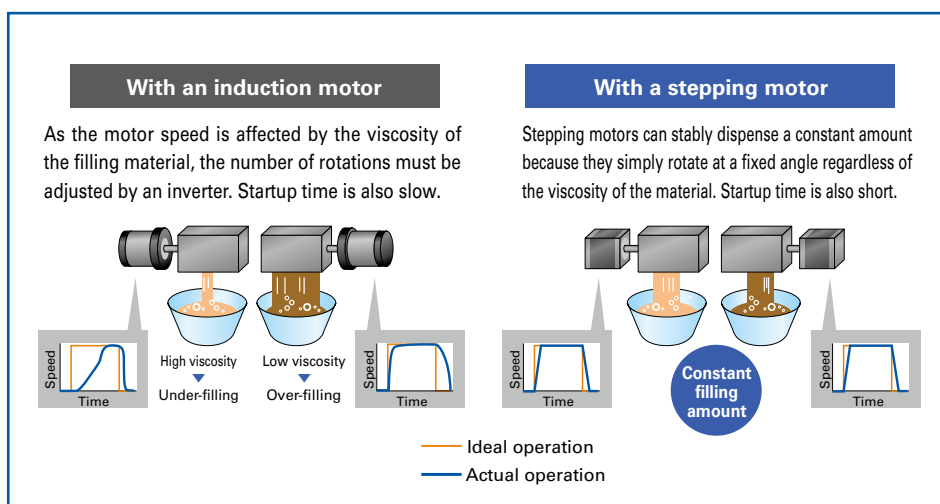
## Belt conveyor

For driving the belt and rollers



## Filling machine

For filling liquids and pastes



# Lineup

## Set Orders ▶ p. 8–

### DC Input

#### Unipolar

We offer orders of a unipolar stepping motor and a DC stepping driver as a set.

**Input voltage:**  
24/36 VDC

**Motor size:**  
28 mm sq., 42 mm sq., 56 mm sq.



#### Bipolar

We offer orders of a bipolar stepping motor and a DC stepping driver as a set.

**Input voltage:**  
24/36 VDC

**Motor size:**  
28 mm sq., 42 mm sq., 50 mm sq., 56 mm sq., 60 mm sq.



The unipolar drive allows current to flow in a single direction along the winding. The drive circuit is simpler than that of the bipolar drive. The bipolar drive allows current to flow in both directions along the winding. The drive circuit is more complex, but it offers higher torque.

## Stepping Motors (Single Items) ▶ p. 31–

### Stepping Motors ▶ p. 36–

These stepping motors feature high torque. Select from among a broad lineup of products from an ultra-compact 14 mm sq. sized motor to a thin-profile motor with a 11.4 mm motor length.

Consult us regarding customization. ▶ p. 34  
A driver is required separately.

**Motor size:**  
14 mm sq., 28 mm sq., 35 mm sq., 42 mm sq., 50 mm sq.,  
56 mm sq., 60 mm sq., 86 mm sq., ø106 mm



### IP65-Rated Stepping Motors Water and dust protection ▶ p. 72–

These IP65-rated motors\* have superior water and dust resistance, and can be safely used in water-exposed environments such as in food processing machines.

\* Except for the shaft and cable ends.

A driver is required separately.

**Motor size:**  
56 mm sq., 86 mm sq.



### In-Vacuum Stepping Motors Custom product ▶ p. 77

We can customize motors for use in low to ultra-high vacuum environments to suit your system requirements.

A driver is required separately.



### Synchronous Motors Custom product ▶ p. 77

Synchronous motors rotate at a constant speed in sync with the AC power frequency. Since they can be driven with AC power directly, a driver is not necessary.



# Lineup Details

## Set Orders ▶ p. 8–

| Series                  |                             | DC input set orders<br>Unipolar                                                                   | DC input set orders<br>Bipolar                                                                    |
|-------------------------|-----------------------------|---------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------|
| Input voltage           |                             | 24/36 VDC                                                                                         | 24/36 VDC                                                                                         |
| Microsteps              |                             | 1, 2, 4, 8, 16                                                                                    | 1, 2, 4, 8, 16                                                                                    |
| Step angle              | 1.8° full step angle motors | 1.8° to 0.1125° /pulse                                                                            | 1.8° to 0.1125° /pulse                                                                            |
|                         | 0.9° full step angle motors | 0.9° to 0.05625° /pulse                                                                           | 0.9° to 0.05625° /pulse                                                                           |
| Motor size              |                             | 28 mm sq., 42 mm sq., 56 mm sq.                                                                   | 28 mm sq., 42 mm sq., 50 mm sq.,<br>56 mm sq., 60 mm sq.                                          |
| Items included in a set |                             | A driver, motor, and motor cable<br>with connectors<br>(Supplied only with connector-type motors) | A driver, motor, and motor cable<br>with connectors<br>(Supplied only with connector-type motors) |
| Page                    |                             | p.10 to 29                                                                                        |                                                                                                   |

## Stepping Motors (Single Items) ▶ p. 31–

### Stepping Motors ▶ p. 36–

| Full step angle | Motor size                     | Holding torque [N·m]                                       | Model no.      | Page                                          |
|-----------------|--------------------------------|------------------------------------------------------------|----------------|-----------------------------------------------|
|                 |                                |                                                            |                | Specifications/Characteristics/<br>Dimensions |
| 0.9°            | 42 mm sq.                      | 0.2 to 0.48                                                | SH142□-□□□1    | p. 41 to 42                                   |
| 0.9°            | 60 mm sq.                      | 0.57 to 2.15                                               | SH160□-□□□0    | p. 56 to 57                                   |
| 1.8°            | 14 mm sq. <b>Ultra-compact</b> | 0.0065 to 0.01                                             | SH214□-5□□1    | p. 36                                         |
| 1.8°            | 28 mm sq.                      | 0.055 to 0.145                                             | SH228□-5□□1    | p. 37 to 38                                   |
| 1.8°            | 35 mm sq.                      | 0.12 to 0.32                                               | SH35□□-1□□□0   | p. 39 to 40                                   |
| 1.8°            | 42 mm sq. <b>Thin-profile</b>  | 0.083 to 0.186                                             | SS242□-50□□□   | p. 43                                         |
| 1.8°            | 42 mm sq.                      | 0.22 to 0.8                                                | SF242□-1□□□1   | p. 44 to 45                                   |
| 1.8°            | 50 mm sq.                      | 0.28 to 0.53                                               | 103H670□-□□□0  | p. 46 to 48                                   |
| 1.8°            | 50 mm sq. <b>Thin-profile</b>  | 0.1 to 0.215                                               | SS250□-80□□0   | p. 49                                         |
| 1.8°            | 56 mm sq. (UL models)          | 0.53 to 2.5                                                | SM256□C□0□□1   | p. 50 to 55                                   |
| 1.8°            | 60 mm sq. *                    | It is recommended you use a 56 mm sq. motor (SM256□C□0□□1) |                | p. 55                                         |
| 1.8°            | 86 mm sq.                      | 2.5 to 9                                                   | SH286□-□□□1    | p. 58 to 61                                   |
| 1.8°            | °106 mm                        | 10.8 to 19                                                 | 103H8922□-□□□1 | p. 62                                         |
| 1.8°            | 56 mm sq. (CE models)          | 0.39 to 1.27                                               | 103H712□-6□□0  | p. 63                                         |
| 1.8°            | 86 mm sq. (CE/UL models)       | 2.5 to 9                                                   | SM286□-□□□□    | p. 64 to 67                                   |
| 1.8°            | °106 mm (CE models)            | 13.2 to 19                                                 | 103H8922□-63□1 | p. 68                                         |

Note: We provide motor customization services such as motors with an encoder, gear, and brake. For more information, see respective specifications and characteristics pages.

\* For 60 mm sq. size: It is recommended you use a 56 mm sq. motor (SM256□C□0□□1) that has equivalent torque as a conventional motor (103H782) with a smaller size. We also offer customization that makes the flange compatible with 60 mm sq. motors for easy replacement.

### IP65-Rated Stepping Motors **Water and dust protection** ▶ p. 72–

| Full step angle | Motor size | Holding torque [N·m] | Safety standards | Model no.   | Page                                          |
|-----------------|------------|----------------------|------------------|-------------|-----------------------------------------------|
|                 |            |                      |                  |             | Specifications/Characteristics/<br>Dimensions |
| 1.8°            | 56 mm sq.  | 1 to 1.7             | CE and UL        | SP256□-5□□0 | p. 73 to 74                                   |
| 1.8°            | 86 mm sq.  | 3.3 to 9             | CE and UL        | SP286□-5□□0 | p. 75 to 76                                   |

### In-Vacuum Stepping Motors **Custom product** ▶ p. 77

| Motor size           |
|----------------------|
| 42 mm sq. to °106 mm |

### Synchronous Motors **Custom product** ▶ p. 77

| Motor size           |
|----------------------|
| 56 mm sq. to °106 mm |

# Set Orders

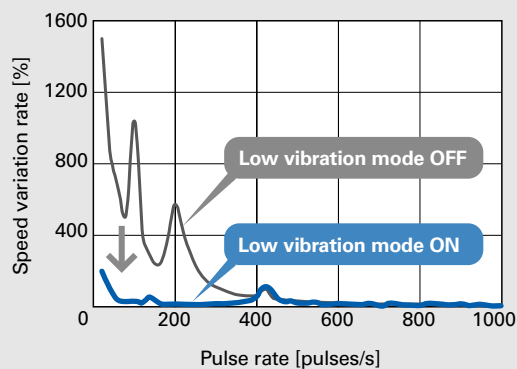
DC Input

► p. 10

## Features

### Low vibration

Thanks to their low vibration mode, SANMOTION F2 stepping drivers can smoothly operate stepping motors even at low resolution settings such as full-step and half-step modes. Vibrations can be suppressed regardless of the host controller.



### Microstepping drive

Resolution settings up to 16 subdivisions of the full step angle can be used, enabling smooth equipment operation with low vibration.



# How to Read Specifications

## Unipolar DC input driver (model: US1D200P10) and stepping motor

RoHS

| ② Size                                 | Motor size                          | 28 mm sq. (1.8° full step angle) |             | 42 mm sq. (1.8° full step angle) |              |
|----------------------------------------|-------------------------------------|----------------------------------|-------------|----------------------------------|--------------|
|                                        | Motor length                        | 32 mm                            | 51.5 mm     | 33 mm                            | 39 mm        |
| ③ Single shaft                         | Set order no.                       | DU14S281S                        | DU14S285S   | DU15S421S                        | DU15S422S    |
|                                        | Motor model no.                     | SH2281-5271                      | SH2285-5271 | SF2421-12U41                     | SF2422-12U41 |
| Dual shaft                             | Set order no.                       | DU14S281D                        | DU14S285D   | DU15S421D                        | DU15S422D    |
|                                        | Motor model no.                     | SH2281-5231                      | SH2285-5231 | SF2421-12U11                     | SF2422-12U11 |
| ④ Holding torque                       | N·m                                 | 0.055                            | 0.115       | 0.22                             | 0.33         |
| ⑤ Rotor inertia                        | ×10 <sup>-4</sup> kg·m <sup>2</sup> | 0.01                             | 0.022       | 0.031                            | 0.046        |
| ⑥ Rated current                        | A/phase                             | 1                                | 1           | 1.2                              | 1.2          |
| ⑦ Motor mass <sup>(1)</sup>            | kg                                  | 0.11                             | 0.2         | 0.23                             | 0.3          |
| ⑧ Allowable thrust load                | N                                   | 3                                | 3           | 10                               | 10           |
| ⑨ Allowable radial load <sup>(2)</sup> | N                                   | 42                               | 49          | 39                               | 37           |

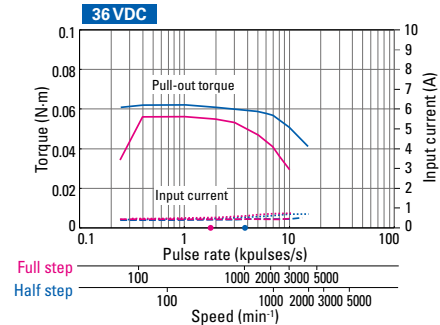
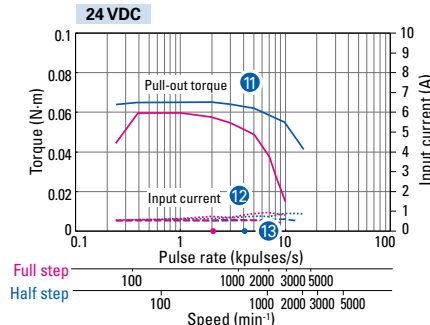
(1) For the driver mass, see ▶ p. 26 (2) Load is exerted to the shaft end.

## ⑩ Characteristics

With rubber coupling used

Pull-out torque Full step Half step fs: Maximum starting pulse rate with no load Full step Half step  
Input current (with no load) Full step Half step Input current (with load) Full step Half step

DU14S281S  
DU14S281D



- ① Model number of the driver included in the set.
- ② Flange size and length of the stepping motor included in the set. The full step angle is the angle at which the motor rotates with each pulse in full step mode. In half step mode, the motor rotates by a half the full step angle with each pulse.
- ③ The set order number and the model number of the stepping motor included in the set. The model number varies depending on whether the motor's shaft is single shaft or dual shaft.
- ④ This is the maximum torque that is generated when the stepping motor is rotated by exerting an external force on the shaft at 2-phase excitation at the rated current.
- ⑤ This is the moment of inertia of the rotor.
- ⑥ This is the rated current that flows to the motor winding.
- ⑦ This is the mass of the stepping motor.
- ⑧ This is the maximum allowable load to the shaft in the axial direction. Take care not to exceed this limit.
- ⑨ This is the maximum allowable load to the shaft in the direction perpendicular to the axial direction. Take care not to exceed this limit.
- ⑩ This graph shows the relationship between the pulse rate (frequency), motor speed, and torque. The driver's input current is shown in addition to the torque. Characteristics in full step mode is shown in red, and in half step mode is shown in blue.
- ⑪ The pull-out torque is the maximum torque in which synchronized operation with command pulses can be maintained. If a torque that exceeds this value is applied to the stepping motor, it will be unable to syn-

chronize with command pulses. Thus, when selecting a motor, you should allow for a torque margin of 1.4 to 2 times, in order to avoid step-out.

- ⑫ This graph shows the current value of the power supply powering the driver.

The red and blue dashed lines show the source current value when there is no load (motor by itself).

The red and blue dotted lines show the source current value when the maximum torque is applied to the stepping motor (with a load).

The required power supply capacity (W) is calculated from this graph.

- ⑬ The red- and blue-colored dots in the lower part of the graph show the upper limit for the maximum starting pulse rate (fs) of the stepping motor by itself (with no load). Values in full step mode is shown in red, and in half step mode is shown in blue. The stepping motor will not operate normally if it is started using pulse rates that exceed these values. For this reason, it is necessary to start the stepping motor using pulse rates that are lower than these values. The maximum starting pulse rate with loads (f<sub>L</sub>) can be determined using the expression below.

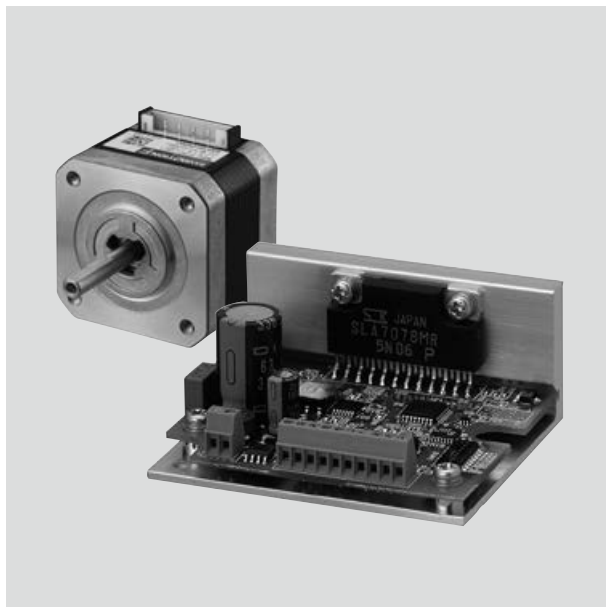
$$f_L = \frac{f_s}{\sqrt{1 + \frac{J_L}{J_M}}}$$

J<sub>M</sub>: Rotor inertia  
J<sub>L</sub>: Load inertia  
f<sub>s</sub>: Maximum starting pulse rate with no load

# DC Input Set Orders

## Unipolar/Bipolar

Items included in a set...▶p. 12 Specifications/Characteristics...▶p. 13 to 21  
Motor dimensions...▶p. 22 to 23 Motor specifications...▶p. 24  
Driver dimensions...▶p. 26 Driver specifications...▶p. 26



### Items included in a set **RoHS**

#### Driver Terminal block type



Unipolar Model no.: US1D200P10 Input voltage: 24/36 VDC

Bipolar Model no.: BS1D200P10 Input voltage: 24/36 VDC

- The Instruction Manual is available for download from our website.
- Drivers are available for separate purchase.

Connector-type drivers are also available. Contact us for details.

#### Motor

(Only for 56 mm sq. motors)

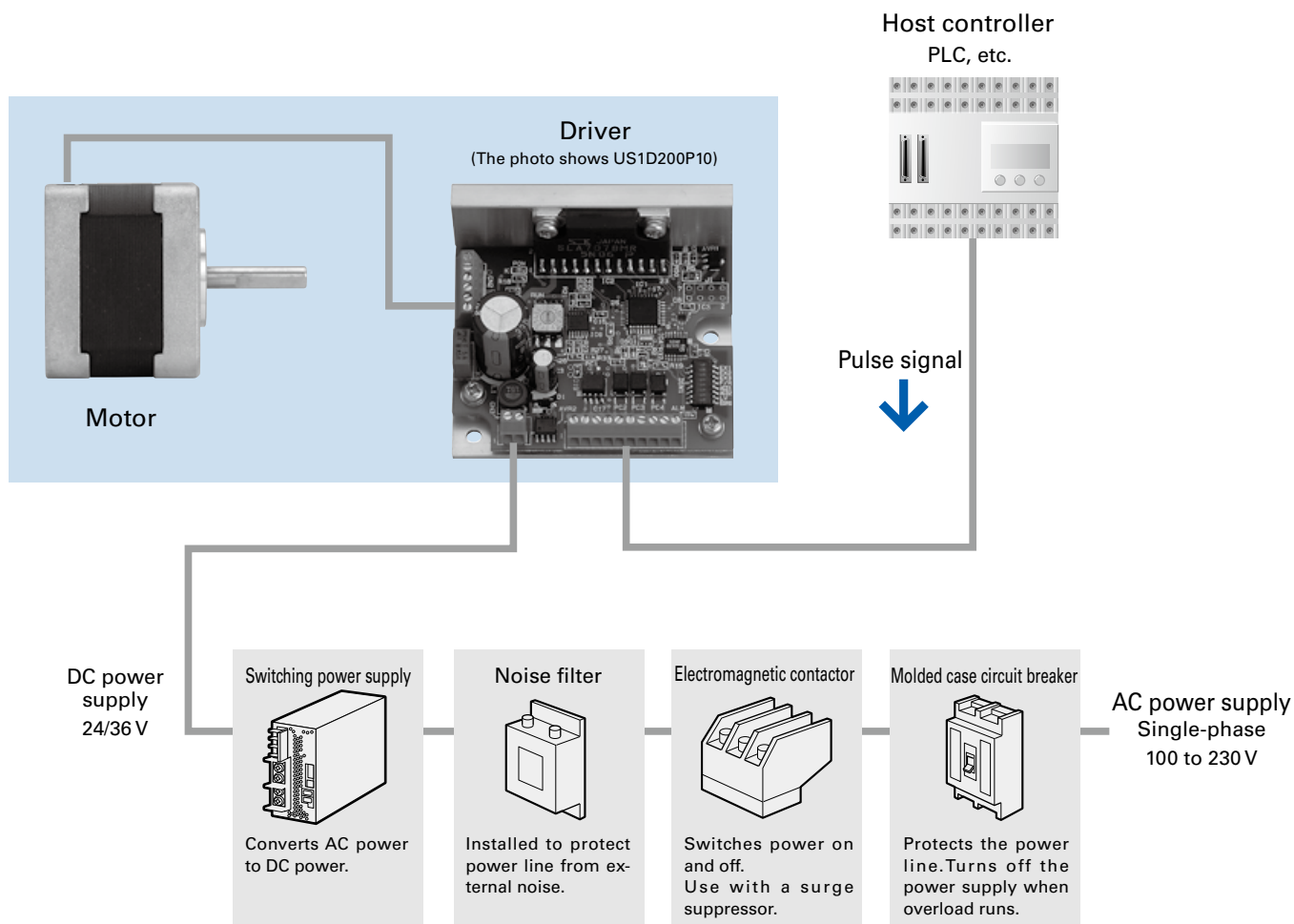
Unipolar motor sizes: 28 mm sq., 42 mm sq., 56 mm sq.

Bipolar motor sizes: 28 mm sq., 42 mm sq., 50 mm sq.,  
56 mm sq., 60 mm sq.

#### Cable with connectors

Supplied only with connector-type motors

## System Configuration



# How to Read Set Order Numbers

Note that not all possible parameter combinations are valid. Contact us or see Items Included in a Set on the next page for details of the items included in individual sets.

e.g., The model number shown below is a set of a DC input driver (US1D200P10) and a motor (SM2561C20U41). The motor's specifications are: 56 mm sq. size, 41.8 mm length, and single shaft.

**D U 1 6 M 71 1 S**

Stepping motor shaft  
S: Single shaft, D: Dual shaft

Stepping motor length

| Name | Motor size      |                   |                 |                   |                 |                   |                 |                   |                 |                   |                 |                   |
|------|-----------------|-------------------|-----------------|-------------------|-----------------|-------------------|-----------------|-------------------|-----------------|-------------------|-----------------|-------------------|
|      | 28 mm sq.       |                   | 42 mm sq.       |                   | 50 mm sq.       |                   | 56 mm sq.       |                   | 60 mm sq.       |                   |                 |                   |
|      | Motor model no. | Motor length [mm] | Motor model no. | Motor length [mm] | Motor model no. | Motor length [mm] | Motor model no. | Motor length [mm] | Motor model no. | Motor length [mm] | Motor model no. | Motor length [mm] |
| 1    | SH2281          | 32                | SF2421          | 33                | SH1421          | 33                | 103H6701        | 39.8              | SM2561          | 41.8              | SH1601          | 42                |
| 2    |                 |                   | SF2422          | 39                | SH1422          | 39                |                 |                   | SM2562          | 53.8              | SH1602          | 54                |
| 3    |                 |                   | SF2423          | 48                |                 |                   | 103H6703        | 51.3              | SM2563          | 75.8              |                 |                   |
| 4    |                 |                   | SF2424          | 59.5              | SH1424          | 48                |                 |                   | SM2564          | 85.8              |                 |                   |
| 5    | SH2285          | 51.5              |                 |                   |                 |                   |                 |                   |                 |                   |                 |                   |

Motor size      Full step angle  
28: 28 mm sq., 1.8°  
42: 42 mm sq., 1.8°  
14: 42 mm sq., 0.9°  
67: 50 mm sq., 1.8°  
71: 56 mm sq., 1.8°  
16: 60 mm sq., 0.9°

Stepping motor series  
H : H series  
S : SH or SF series  
M : SM series

Rated current  
4: 1 A/phase, 5: 1.2 A/phase, 6: 2 A/phase

Model

Windings  
U: Unipolar, B: Bipolar

D: DC input

# Items Included in a Set

These sets include a driver, motor, and motor cable with connectors.

Motors marked with (L) are lead-type motors. 300 mm or longer leads are attached to the motor.

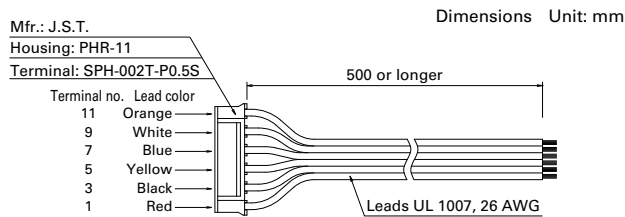
Motors marked with (C) are connector-type motors. The following motor cables with connectors are included.

## Unipolar Bundled driver model no.: US1D200P10

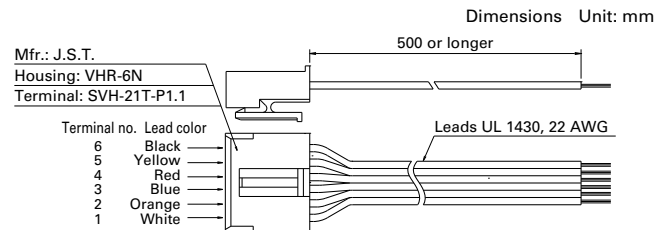
| Motor size | Single shaft  |                         |                                       | Dual shaft    |                         |                                       | Full step angle | Rated current [A/phase] | Page            |             |
|------------|---------------|-------------------------|---------------------------------------|---------------|-------------------------|---------------------------------------|-----------------|-------------------------|-----------------|-------------|
|            | Set order no. | Items included in a set |                                       | Set order no. | Items included in a set |                                       |                 |                         | Specifi-cations | Dimen-sions |
|            |               | Motor model no.         | Motor cable with connectors model no. |               | Motor model no.         | Motor cable with connectors model no. |                 |                         |                 |             |
| 28 mm sq.  | DU14S281S     | SH2281-5271             | L –                                   | DU14S281D     | SH2281-5231             | L –                                   | 1.8°            | 1                       | p. 13           | p. 22       |
|            | DU14S285S     | SH2285-5271             | L –                                   | DU14S285D     | SH2285-5231             | L –                                   | 1.8°            | 1                       | p. 13           | p. 22       |
| 42 mm sq.  | DU15S421S     | SF2421-12U41            | C 4835774-1                           | DU15S421D     | SF2421-12U11            | C 4835774-1                           | 1.8°            | 1.2                     | p. 13           | p. 22       |
|            | DU15S422S     | SF2422-12U41            | C 4835774-1                           | DU15S422D     | SF2422-12U11            | C 4835774-1                           | 1.8°            | 1.2                     | p. 13           | p. 22       |
|            | DU15S423S     | SF2423-12U41            | C 4835774-1                           | DU15S423D     | SF2423-12U11            | C 4835774-1                           | 1.8°            | 1.2                     | p. 14           | p. 22       |
|            | DU15S424S     | SF2424-12U41            | C 4835774-1                           | DU15S424D     | SF2424-12U11            | C 4835774-1                           | 1.8°            | 1.2                     | p. 14           | p. 22       |
|            | DU15S141S     | SH1421-0441             | L –                                   | DU15S141D     | SH1421-0411             | L –                                   | 0.9°            | 1.2                     | p. 14           | p. 22       |
|            | DU15S142S     | SH1422-0441             | L –                                   | DU15S142D     | SH1422-0411             | L –                                   | 0.9°            | 1.2                     | p. 14           | p. 22       |
|            | DU15S144S     | SH1424-0441             | L –                                   | DU15S144D     | SH1424-0411             | L –                                   | 0.9°            | 1.2                     | p. 15           | p. 22       |
| 56 mm sq.  | DU16M711S     | SM2561C20U41            | C 4837798-1                           | DU16M711D     | SM2561C20U11            | C 4837798-1                           | 1.8°            | 2                       | p. 15           | p. 23       |
|            | DU16M712S     | SM2562C20U41            | C 4837798-1                           | DU16M712D     | SM2562C20U11            | C 4837798-1                           | 1.8°            | 2                       | p. 15           | p. 23       |
|            | DU16M713S     | SM2563C20U41            | C 4837798-1                           | DU16M713D     | SM2563C20U11            | C 4837798-1                           | 1.8°            | 2                       | p. 15           | p. 23       |
|            | DU16M714S     | SM2564C20U41            | C 4837798-1                           | DU16M714D     | SM2564C20U11            | C 4837798-1                           | 1.8°            | 2                       | p. 16           | p. 23       |

• Motor cable with connectors Note: Included with connector-type motors only

For 42 mm sq. unipolar motors (Model no.: 4835774-1)



For 56 mm sq. unipolar motors (Model no.: 4837798-1)

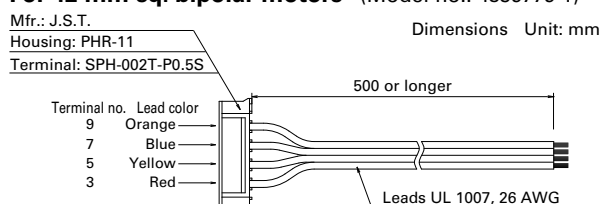


## Bipolar Bundled driver model no.: BS1D200P10

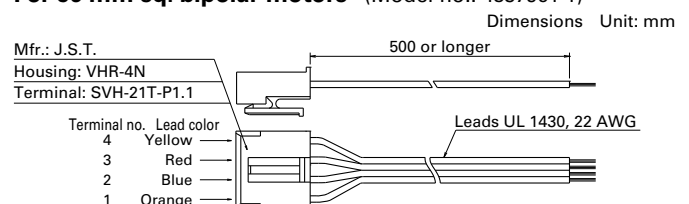
| Motor size | Single shaft  |                         |                                       | Dual shaft    |                         |                                       | Full step angle | Rated current [A/phase] | Page            |             |
|------------|---------------|-------------------------|---------------------------------------|---------------|-------------------------|---------------------------------------|-----------------|-------------------------|-----------------|-------------|
|            | Set order no. | Items included in a set |                                       | Set order no. | Items included in a set |                                       |                 |                         | Specifi-cations | Dimen-sions |
|            |               | Motor model no.         | Motor cable with connectors model no. |               | Motor model no.         | Motor cable with connectors model no. |                 |                         |                 |             |
| 28 mm sq.  | DB14S281S     | SH2281-5771             | L –                                   | DB14S281D     | SH2281-5731             | L –                                   | 1.8°            | 1                       | p. 17           | p. 22       |
|            | DB14S285S     | SH2285-5771             | L –                                   | DB14S285D     | SH2285-5731             | L –                                   | 1.8°            | 1                       | p. 17           | p. 22       |
| 42 mm sq.  | DB14S421S     | SF2421-10B41            | C 4835775-1                           | DB14S421D     | SF2421-10B11            | C 4835775-1                           | 1.8°            | 1                       | p. 17           | p. 22       |
|            | DB14S422S     | SF2422-10B41            | C 4835775-1                           | DB14S422D     | SF2422-10B11            | C 4835775-1                           | 1.8°            | 1                       | p. 17           | p. 22       |
|            | DB14S423S     | SF2423-10B41            | C 4835775-1                           | DB14S423D     | SF2423-10B11            | C 4835775-1                           | 1.8°            | 1                       | p. 18           | p. 22       |
|            | DB14S424S     | SF2424-10B41            | C 4835775-1                           | DB14S424D     | SF2424-10B11            | C 4835775-1                           | 1.8°            | 1                       | p. 18           | p. 22       |
|            | DB16S141S     | SH1421-5241             | L –                                   | DB16S141D     | SH1421-5211             | L –                                   | 0.9°            | 2                       | p. 18           | p. 22       |
|            | DB16S142S     | SH1422-5241             | L –                                   | DB16S142D     | SH1422-5211             | L –                                   | 0.9°            | 2                       | p. 18           | p. 22       |
|            | DB16S144S     | SH1424-5241             | L –                                   | DB16S144D     | SH1424-5211             | L –                                   | 0.9°            | 2                       | p. 19           | p. 22       |
|            | DB16H671S     | 103H6701-5040           | L –                                   | DB16H671D     | 103H6701-5010           | L –                                   | 1.8°            | 2                       | p. 19           | p. 23       |
| 50 mm sq.  | DB16H673S     | 103H6703-5040           | L –                                   | DB16H673D     | 103H6703-5010           | L –                                   | 1.8°            | 2                       | p. 19           | p. 23       |
| 56 mm sq.  | DB16M711S     | SM2561C20B41            | C 4837961-1                           | DB16M711D     | SM2561C20B11            | C 4837961-1                           | 1.8°            | 2                       | p. 19           | p. 23       |
|            | DB16M712S     | SM2562C20B41            | C 4837961-1                           | DB16M712D     | SM2562C20B11            | C 4837961-1                           | 1.8°            | 2                       | p. 20           | p. 23       |
|            | DB16M713S     | SM2563C20B41            | C 4837961-1                           | DB16M713D     | SM2563C20B11            | C 4837961-1                           | 1.8°            | 2                       | p. 20           | p. 23       |
|            | DB16M714S     | SM2564C20B41            | C 4837961-1                           | DB16M714D     | SM2564C20B11            | C 4837961-1                           | 1.8°            | 2                       | p. 20           | p. 23       |
| 60 mm sq.  | DB16S161S     | SH1601-5240             | L –                                   | DB16S161D     | SH1601-5210             | L –                                   | 0.9°            | 2                       | p. 20           | p. 23       |
|            | DB16S162S     | SH1602-5240             | L –                                   | DB16S162D     | SH1602-5210             | L –                                   | 0.9°            | 2                       | p. 21           | p. 23       |

• Motor cable with connectors Note: Included with connector-type motors only

For 42 mm sq. bipolar motors (Model no.: 4835775-1)



For 56 mm sq. bipolar motors (Model no.: 4837961-1)



| Size                                 | Motor size                         | 28 mm sq. (1.8° full step angle) |             | 42 mm sq. (1.8° full step angle) |              |
|--------------------------------------|------------------------------------|----------------------------------|-------------|----------------------------------|--------------|
|                                      |                                    | 32 mm                            | 51.5 mm     | 33 mm                            | 39 mm        |
| Single shaft                         | Set order no.                      | DU14S281S                        | DU14S285S   | DU15S421S                        | DU15S422S    |
|                                      | Motor model no.                    | SH2281-5271                      | SH2285-5271 | SF2421-12U41                     | SF2422-12U41 |
| Dual shaft                           | Set order no.                      | DU14S281D                        | DU14S285D   | DU15S421D                        | DU15S422D    |
|                                      | Motor model no.                    | SH2281-5231                      | SH2285-5231 | SF2421-12U11                     | SF2422-12U11 |
| Holding torque                       | N·m                                | 0.055                            | 0.115       | 0.22                             | 0.33         |
| Rotor inertia                        | $\times 10^{-4}$ kg·m <sup>2</sup> | 0.01                             | 0.022       | 0.031                            | 0.046        |
| Rated current                        | A/phase                            | 1                                | 1           | 1.2                              | 1.2          |
| Motor mass <sup>(1)</sup>            | kg                                 | 0.11                             | 0.2         | 0.23                             | 0.3          |
| Allowable thrust load                | N                                  | 3                                | 3           | 10                               | 10           |
| Allowable radial load <sup>(2)</sup> | N                                  | 42                               | 49          | 39                               | 37           |

(1) For the driver mass, see ▶ p. 26

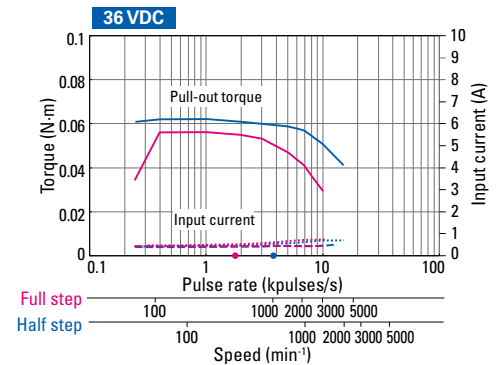
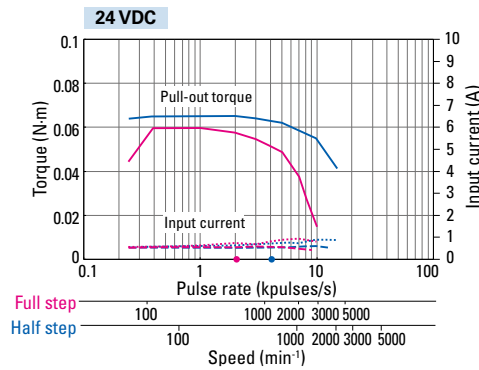
(2) Load is exerted to the shaft end.

## Characteristics

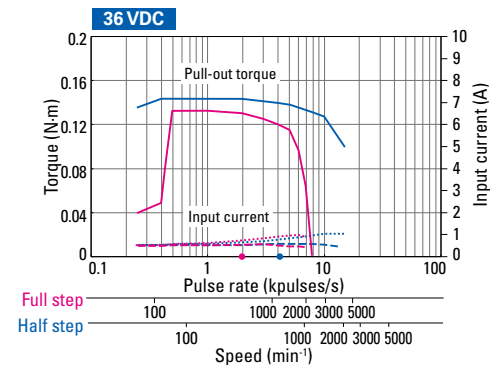
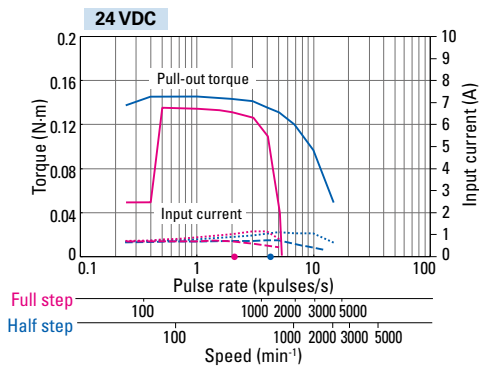
With rubber coupling used

Pull-out torque    Full step —    Half step —    fs: Maximum starting pulse rate with no load    Full step ●    Half step ●  
Input current (with no load)    Full step - - -    Half step - - -    Input current (with load)    Full step ·····    Half step ·····

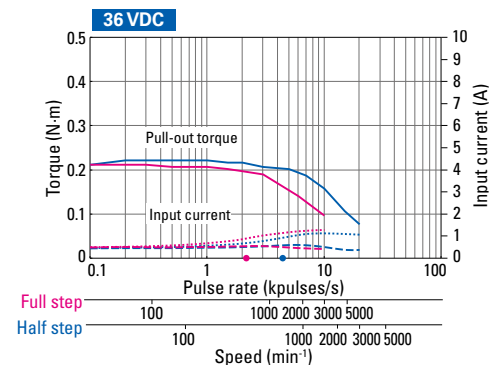
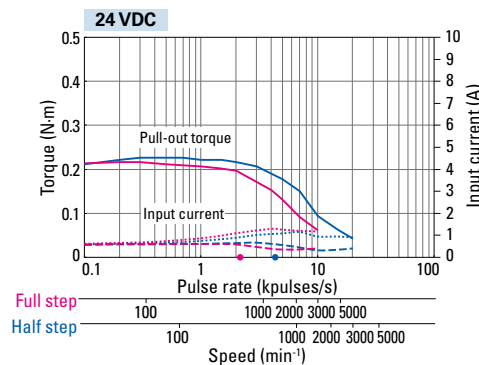
### DU14S281S DU14S281D



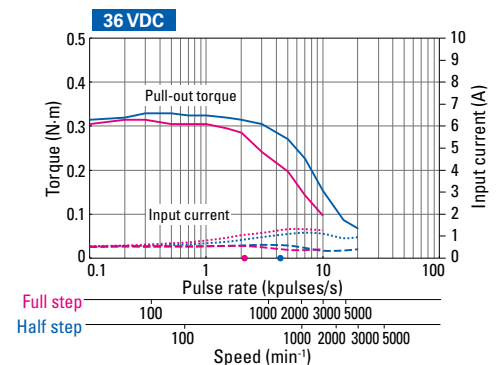
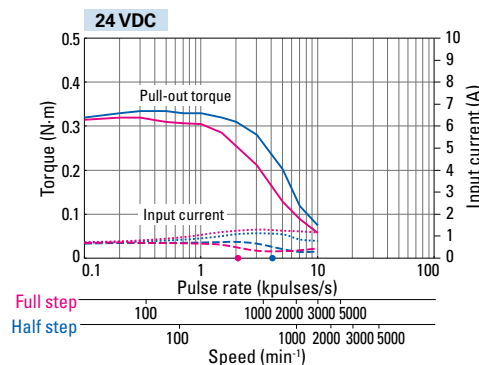
### DU14S285S DU14S285D



### DU15S421S DU15S421D



### DU15S422S DU15S422D



| Size                                 | Motor size      | 42 mm sq. (1.8° full step angle) |              | 42 mm sq. (0.9° full step angle) |             |
|--------------------------------------|-----------------|----------------------------------|--------------|----------------------------------|-------------|
|                                      |                 | 48 mm                            | 59.5 mm      | 33 mm                            | 39 mm       |
| Single shaft                         | Set order no.   | DU15S423S                        | DU15S424S    | DU15S141S                        | DU15S142S   |
|                                      | Motor model no. | SF2423-12U41                     | SF2424-12U41 | SH1421-0441                      | SH1422-0441 |
| Dual shaft                           | Set order no.   | DU15S423D                        | DU15S424D    | DU15S141D                        | DU15S142D   |
|                                      | Motor model no. | SF2423-12U11                     | SF2424-12U11 | SH1421-0411                      | SH1422-0411 |
| Holding torque                       |                 | 0.4                              | 0.58         | 0.2                              | 0.29        |
| Rotor inertia                        |                 | 0.063                            | 0.094        | 0.044                            | 0.066       |
| Rated current                        |                 | 1.2                              | 1.2          | 1.2                              | 1.2         |
| Motor mass <sup>(1)</sup>            |                 | 0.38                             | 0.51         | 0.24                             | 0.29        |
| Allowable thrust load                |                 | 10                               | 10           | 10                               | 10          |
| Allowable radial load <sup>(2)</sup> |                 | 35                               | 29           | 25                               | 24          |

(1) For the driver mass, see ▶ p. 26

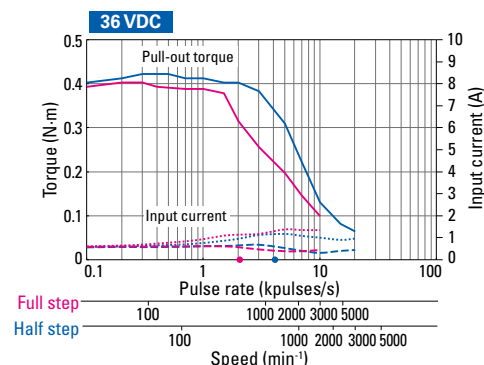
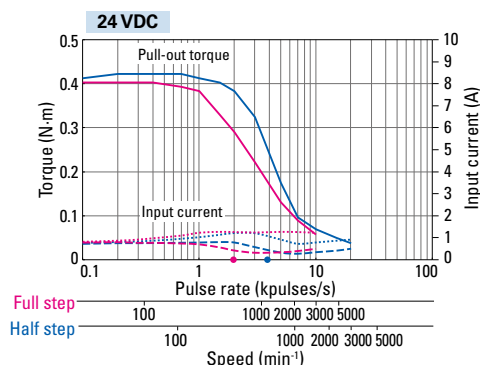
(2) Load is exerted to the shaft end.

### Characteristics

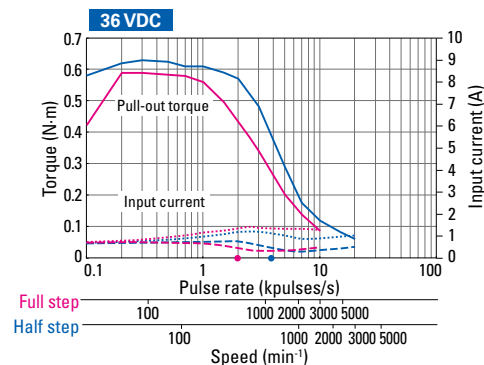
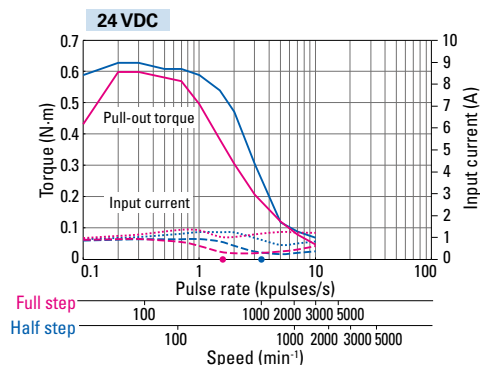
With rubber coupling used

Pull-out torque    Full step    Half step    fs: Maximum starting pulse rate with no load    Full step    Half step  
Input current (with no load)    Full step    Half step    Input current (with load)    Full step    Half step

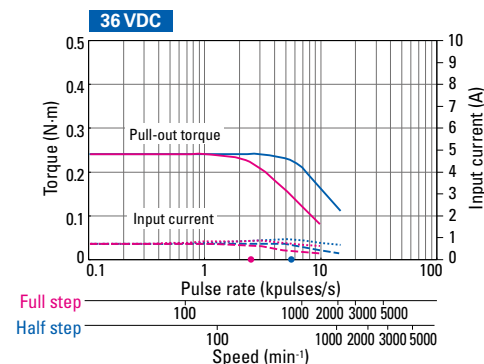
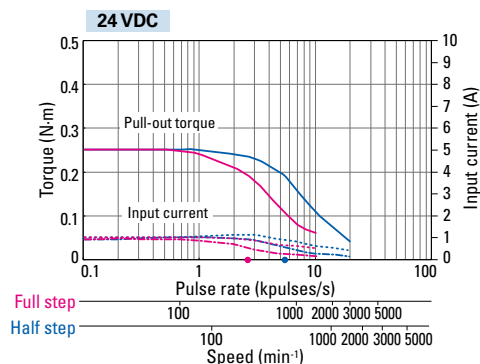
#### DU15S423S DU15S423D



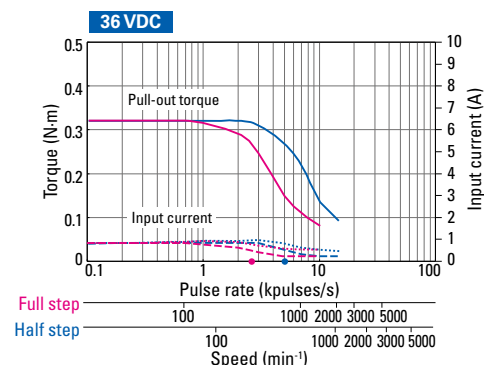
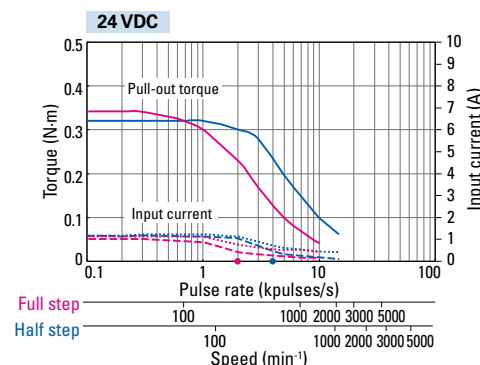
#### DU15S424S DU15S424D



#### DU15S141S DU15S141D



#### DU15S142S DU15S142D





| Size                                 | Motor size      | 42 mm sq. (0.9° full step angle)   |  | 56 mm sq. (1.8° full step angle) |              |              |     |
|--------------------------------------|-----------------|------------------------------------|--|----------------------------------|--------------|--------------|-----|
|                                      | Motor length    | 48 mm                              |  | 41.8 mm                          | 53.8 mm      | 75.8 mm      |     |
| Single shaft                         | Set order no.   | DU15S144S                          |  | DU16M711S                        | DU16M712S    | DU16M713S    |     |
|                                      | Motor model no. | SH1424-0441                        |  | SM2561C20U41                     | SM2562C20U41 | SM2563C20U41 |     |
| Dual shaft                           | Set order no.   | DU15S144D                          |  | DU16M711D                        | DU16M712D    | DU16M713D    |     |
|                                      | Motor model no. | SH1424-0411                        |  | SM2561C20U11                     | SM2562C20U11 | SM2563C20U11 |     |
| Holding torque                       |                 | N·m                                |  | 0.39                             | 0.53         | 1.1          | 1.7 |
| Rotor inertia                        |                 | $\times 10^{-4}$ kg·m <sup>2</sup> |  | 0.089                            | 0.14         | 0.28         | 0.5 |
| Rated current                        |                 | A/phase                            |  | 1.2                              | 2            | 2            | 2   |
| Motor mass <sup>(1)</sup>            |                 | kg                                 |  | 0.38                             | 0.49         | 0.69         | 1.1 |
| Allowable thrust load                |                 | N                                  |  | 10                               | 20           | 20           | 20  |
| Allowable radial load <sup>(2)</sup> |                 | N                                  |  | 20                               | 115          | 106          | 93  |

(1) For the driver mass, see ▶ p. 26

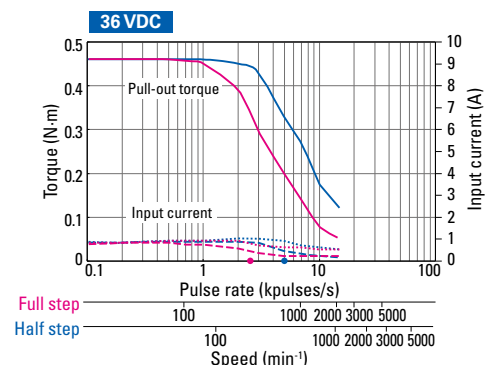
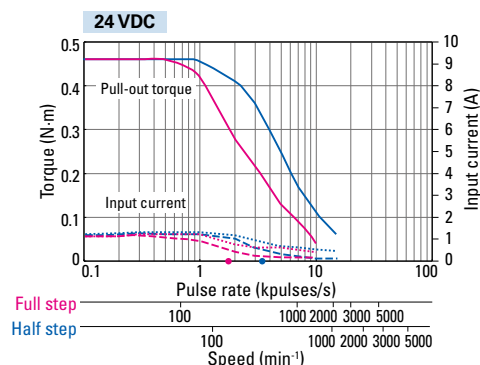
(2) Load is exerted to the shaft end.

## Characteristics

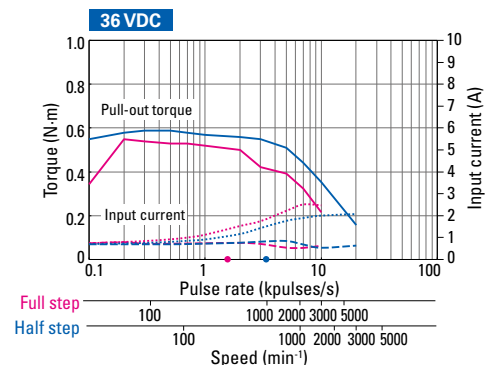
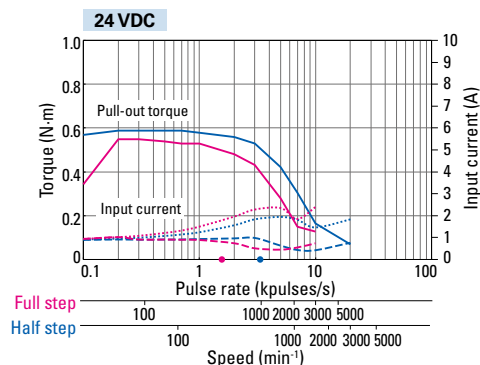
With rubber coupling used

Pull-out torque    Full step —    Half step —    fs: Maximum starting pulse rate with no load    Full step ●    Half step ●  
Input current (with no load)    Full step - - -    Half step - - -    Input current (with load)    Full step ·····    Half step ·····

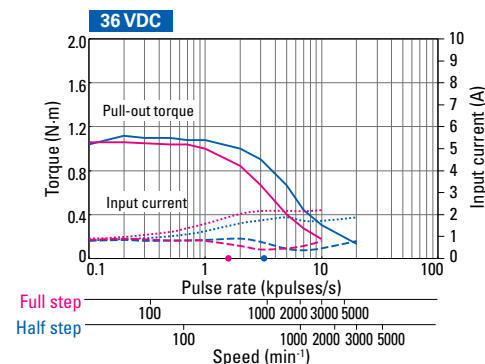
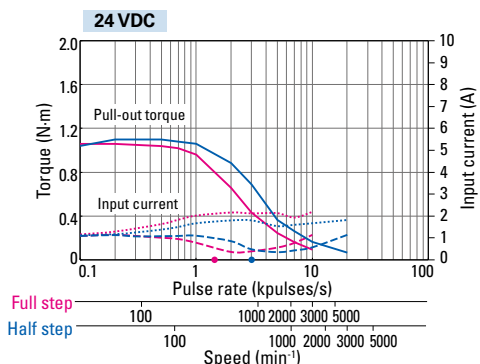
### DU15S144S DU15S144D



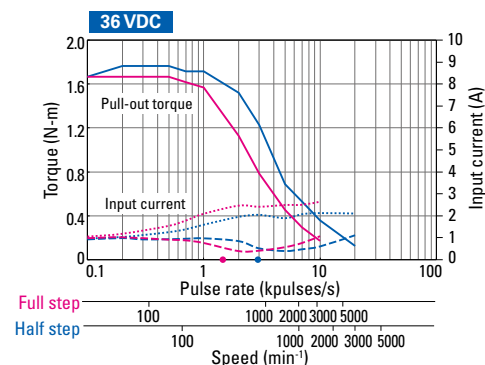
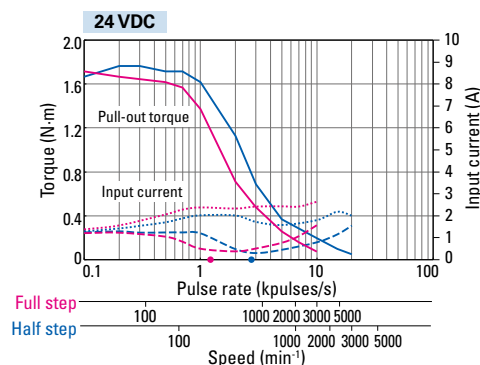
### DU16M711S DU16M711D



### DU16M712S DU16M712D



### DU16M713S DU16M713D



## Unipolar DC input driver (model: US1D200P10) and stepping motor

RoHS

|                                      |                                    |                                  |
|--------------------------------------|------------------------------------|----------------------------------|
| Size                                 | Motor size                         | 56 mm sq. (1.8° full step angle) |
|                                      | Motor length                       | 85.8 mm                          |
| Single shaft                         | Set order no.                      | DU16M714S                        |
|                                      | Motor model no.                    | SM2564C20U41                     |
| Dual shaft                           | Set order no.                      | DU16M714D                        |
|                                      | Motor model no.                    | SM2564C20U11                     |
| Holding torque                       | N·m                                | 1.75                             |
| Rotor inertia                        | $\times 10^{-4}$ kg·m <sup>2</sup> | 0.6                              |
| Rated current                        | A/phase                            | 2                                |
| Motor mass <sup>(1)</sup>            | kg                                 | 1.27                             |
| Allowable thrust load                | N                                  | 20                               |
| Allowable radial load <sup>(2)</sup> | N                                  | 86                               |

(1) For the driver mass, see ▶ p. 26

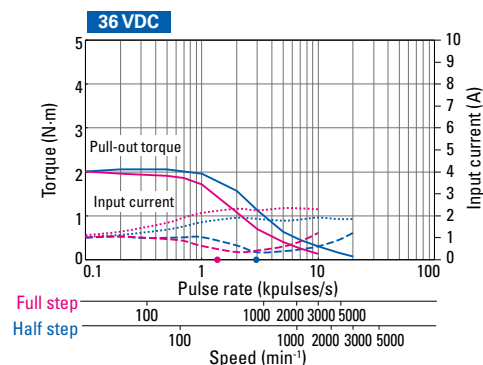
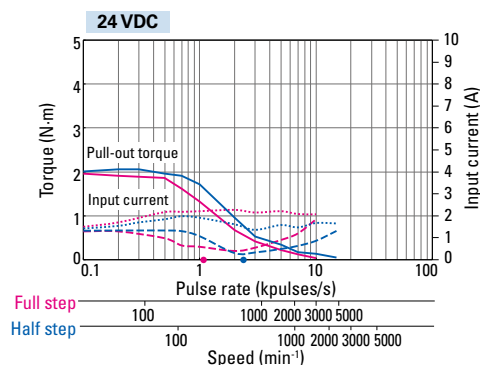
(2) Load is exerted to the shaft end.

## Characteristics

With rubber coupling used

Pull-out torque    Full step —    Half step —    fs: Maximum starting pulse rate with no load    Full step ●    Half step ●  
Input current (with no load)    Full step - - -    Half step - - -    Input current (with load)    Full step .....    Half step .....

DU16M714S  
DU16M714D



| Size                                 | Motor size      | 28 mm sq. (1.8° full step angle)     |             | 42 mm sq. (1.8° full step angle) |              |       |
|--------------------------------------|-----------------|--------------------------------------|-------------|----------------------------------|--------------|-------|
|                                      | Motor length    | 32 mm                                | 51.5 mm     | 33 mm                            | 39 mm        |       |
| Single shaft                         | Set order no.   | DB14S281S                            | DB14S285S   | DB14S421S                        | DB14S422S    |       |
|                                      | Motor model no. | SH2281-5771                          | SH2285-5771 | SF2421-10B41                     | SF2422-10B41 |       |
| Dual shaft                           | Set order no.   | DB14S281D                            | DB14S285D   | DB14S421D                        | DB14S422D    |       |
|                                      | Motor model no. | SH2281-5731                          | SH2285-5731 | SF2421-10B11                     | SF2422-10B11 |       |
| Holding torque                       |                 | N·m                                  | 0.07        | 0.145                            | 0.29         | 0.43  |
| Rotor inertia                        |                 | × 10 <sup>-4</sup> kg·m <sup>2</sup> | 0.01        | 0.022                            | 0.031        | 0.046 |
| Rated current                        |                 | A/phase                              | 1           | 1                                | 1            | 1     |
| Motor mass <sup>(1)</sup>            |                 | kg                                   | 0.11        | 0.2                              | 0.23         | 0.3   |
| Allowable thrust load                |                 | N                                    | 3           | 3                                | 10           | 10    |
| Allowable radial load <sup>(2)</sup> |                 | N                                    | 42          | 49                               | 38           | 34    |

(1) For the driver mass, see ▶ p. 26

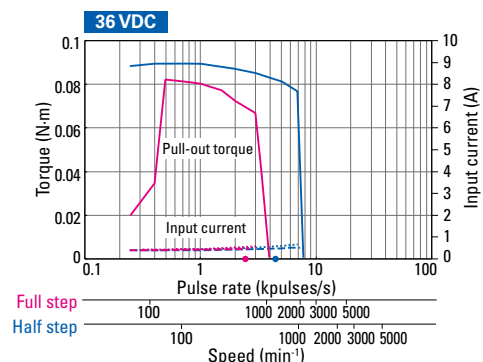
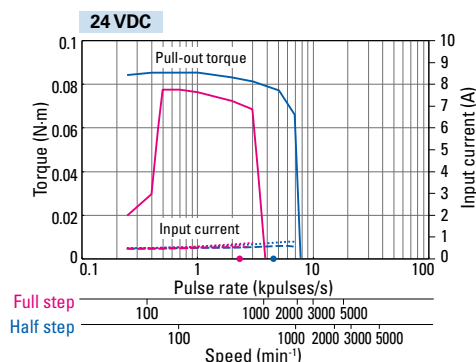
(2) Load is exerted to the shaft end.

## Characteristics

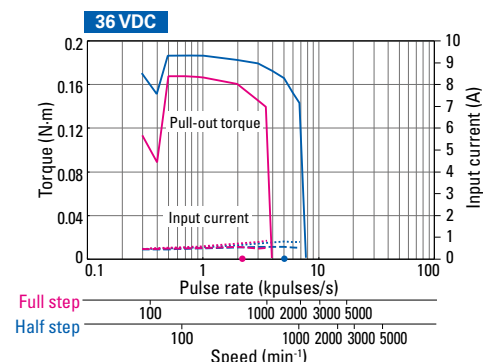
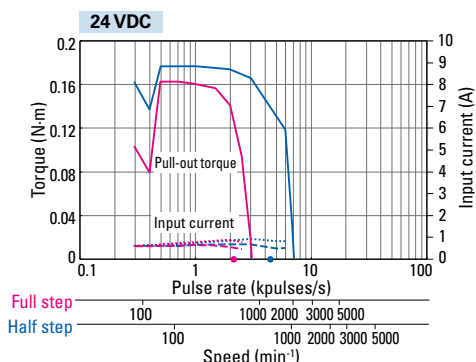
With rubber coupling used

Pull-out torque    Full step    Half step    fs: Maximum starting pulse rate with no load    Full step    Half step  
Input current (with no load)    Full step    Half step    Input current (with load)    Full step    Half step

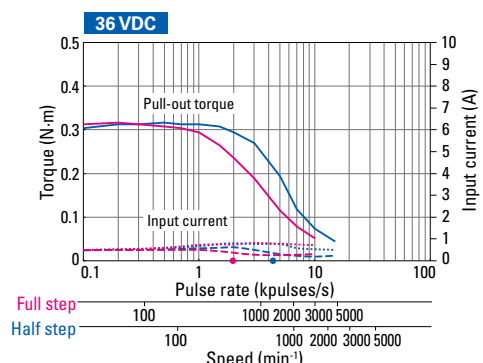
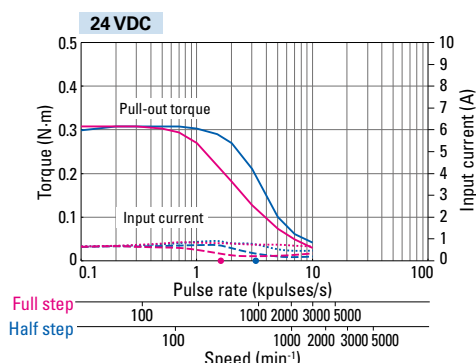
### DB14S281S DB14S281D



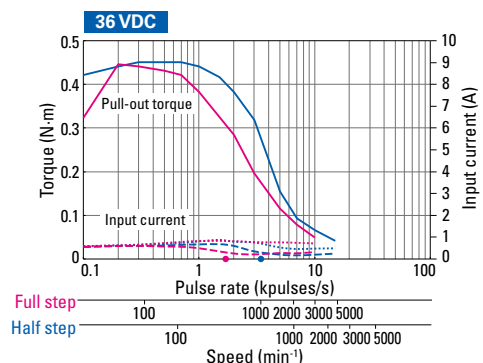
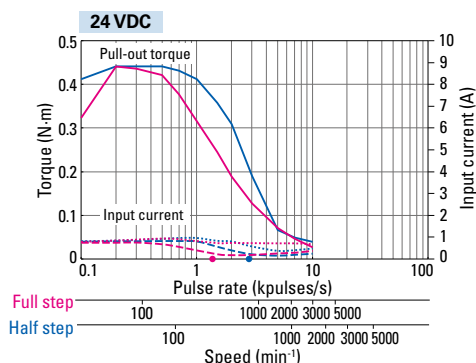
### DB14S285S DB14S285D



### DB14S421S DB14S421D



### DB14S422S DB14S422D



| Size                                 | Motor size      | 42 mm sq. (1.8° full step angle)   |              | 42 mm sq. (0.9° full step angle) |             |
|--------------------------------------|-----------------|------------------------------------|--------------|----------------------------------|-------------|
|                                      |                 | 48 mm                              | 59.5 mm      | 33 mm                            | 39 mm       |
| Single shaft                         | Set order no.   | DB14S423S                          | DB14S424S    | DB16S141S                        | DB16S142S   |
|                                      | Motor model no. | SF2423-10B41                       | SF2424-10B41 | SH1421-5241                      | SH1422-5241 |
| Dual shaft                           | Set order no.   | DB14S423D                          | DB14S424D    | DB16S141D                        | DB16S142D   |
|                                      | Motor model no. | SF2423-10B11                       | SF2424-10B11 | SH1421-5211                      | SH1422-5211 |
| Holding torque                       |                 | N·m                                |              |                                  |             |
| Rotor inertia                        |                 | $\times 10^{-4}$ kg·m <sup>2</sup> |              |                                  |             |
| Rated current                        |                 | A/phase                            |              |                                  |             |
| Motor mass <sup>(1)</sup>            |                 | kg                                 |              |                                  |             |
| Allowable thrust load                |                 | N                                  |              |                                  |             |
| Allowable radial load <sup>(2)</sup> |                 | N                                  |              |                                  |             |
|                                      |                 |                                    |              |                                  |             |

(1) For the driver mass, see ▶ p. 26

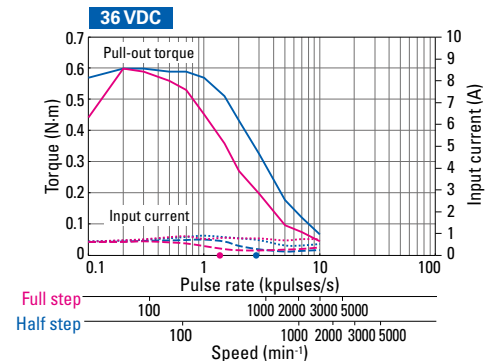
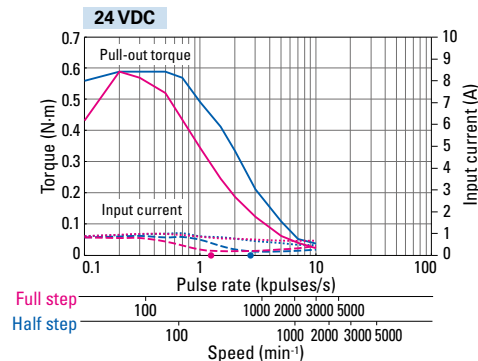
(2) Load is exerted to the shaft end.

### Characteristics

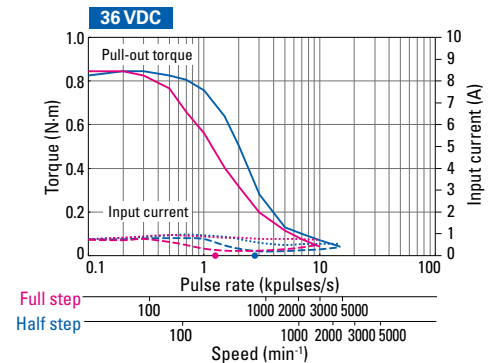
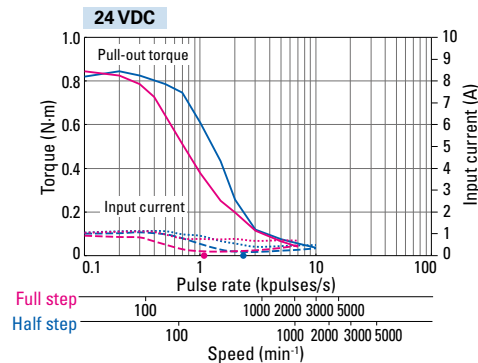
With rubber coupling used

Pull-out torque Full step — Half step — fs: Maximum starting pulse rate with no load Full step ● Half step ●  
Input current (with no load) Full step - - - Half step - - - Input current (with load) Full step ..... Half step .....

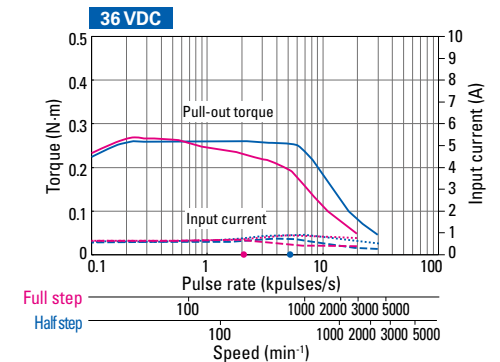
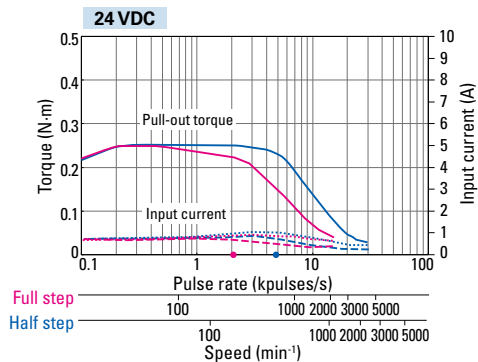
#### DB14S423S DB14S423D



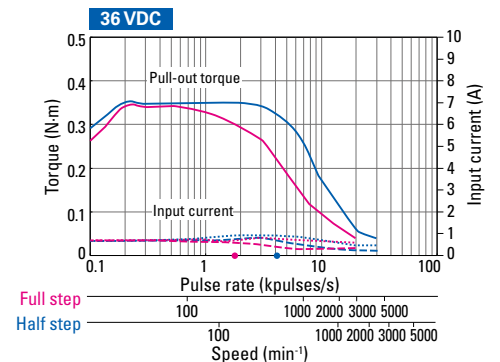
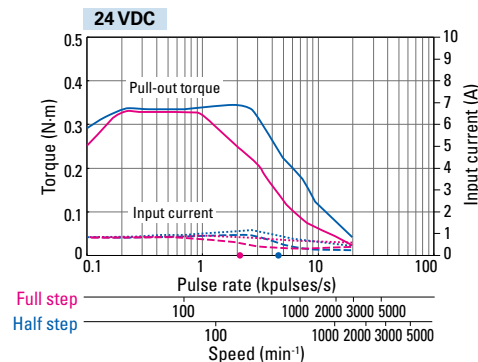
#### DB14S424S DB14S424D



#### DB16S141S DB16S141D



#### DB16S142S DB16S142D



| Size                                 |                                    | 42 mm sq. (0.9° full step angle) | 50 mm sq. (1.8° full step angle) |               | 56 mm sq. (1.8° full step angle) |
|--------------------------------------|------------------------------------|----------------------------------|----------------------------------|---------------|----------------------------------|
| Motor size                           |                                    | 48 mm                            | 39.8 mm                          | 51.3 mm       | 41.8 mm                          |
| Motor length                         |                                    | 48 mm                            | 39.8 mm                          | 51.3 mm       | 41.8 mm                          |
| Single shaft                         | Set order no.                      | DB16S144S                        | DB16H671S                        | DB16H673S     | DB16M711S                        |
|                                      | Motor model no.                    | SH1424-5241                      | 103H6701-5040                    | 103H6703-5040 | SM2561C20B41                     |
| Dual shaft                           | Set order no.                      | DB16S144D                        | DB16H671D                        | DB16H673D     | DB16M711D                        |
|                                      | Motor model no.                    | SH1424-5211                      | 103H6701-5010                    | 103H6703-5010 | SM2561C20B11                     |
| Holding torque                       | N·m                                | 0.48                             | 0.28                             | 0.49          | 0.75                             |
| Rotor inertia                        | $\times 10^{-4}$ kg·m <sup>2</sup> | 0.089                            | 0.057                            | 0.118         | 0.14                             |
| Rated current                        | A/phase                            | 2                                | 2                                | 2             | 2                                |
| Motor mass <sup>(1)</sup>            | kg                                 | 0.38                             | 0.35                             | 0.5           | 0.49                             |
| Allowable thrust load                | N                                  | 10                               | 15                               | 15            | 20                               |
| Allowable radial load <sup>(2)</sup> | N                                  | 20                               | 79                               | 75            | 113                              |

(1) For the driver mass, see ▶ p. 26

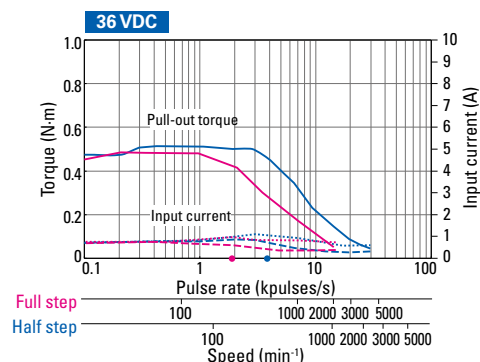
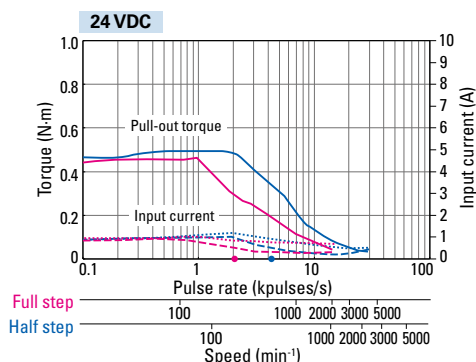
(2) Load is exerted to the shaft end.

## Characteristics

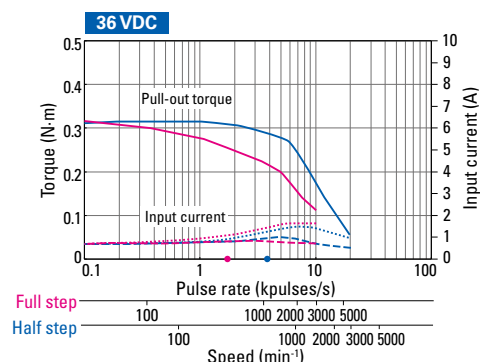
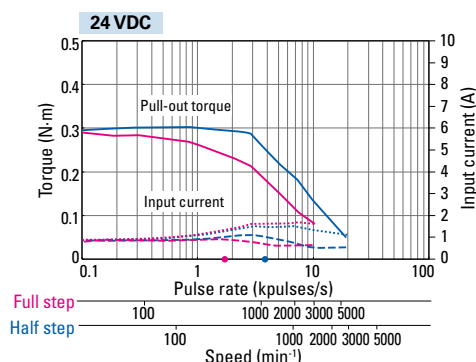
With rubber coupling used

Pull-out torque    Full step    Half step    fs: Maximum starting pulse rate with no load    Full step    Half step  
Input current (with no load)    Full step    Half step    Input current (with load)    Full step    Half step

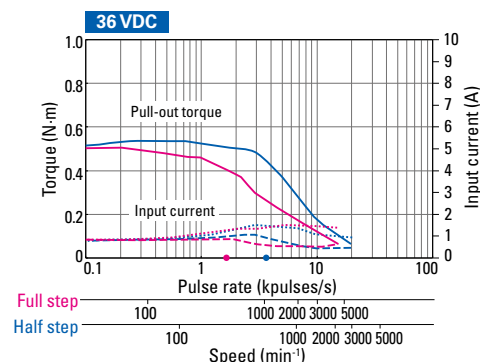
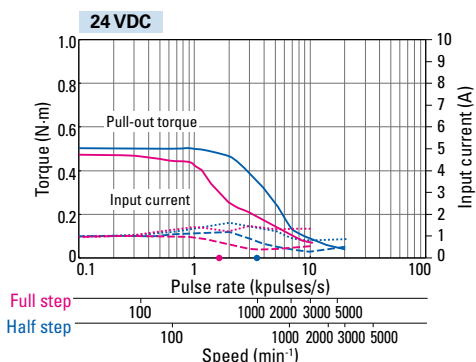
### DB16S144S DB16S144D



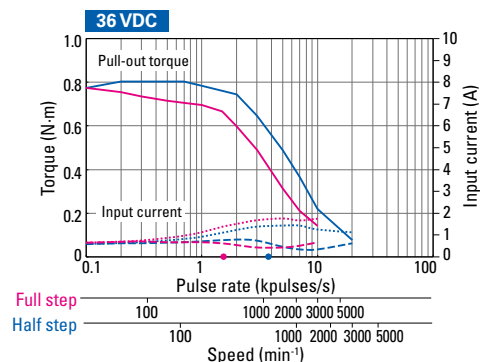
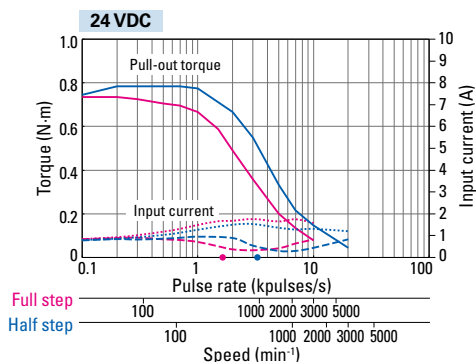
### DB16H671S DB16H671D



### DB16H673S DB16H673D



### DB16M711S DB16M711D



| Size                                 | Motor size      |                                      | 56 mm sq. (1.8° full step angle) |              |              | 60 mm sq. (0.9° full step angle) |
|--------------------------------------|-----------------|--------------------------------------|----------------------------------|--------------|--------------|----------------------------------|
|                                      | Motor length    |                                      | 53.8 mm                          | 75.8 mm      | 85.8 mm      | 42 mm                            |
| Single shaft                         | Set order no.   |                                      | DB16M712S                        | DB16M713S    | DB16M714S    | DB16S161S                        |
|                                      | Motor model no. |                                      | SM2562C20B41                     | SM2563C20B41 | SM2564C20B41 | SH1601-5240                      |
| Dual shaft                           | Set order no.   |                                      | DB16M712D                        | DB16M713D    | DB16M714D    | DB16S161D                        |
|                                      | Motor model no. |                                      | SM2562C20B11                     | SM2563C20B11 | SM2564C20B11 | SH1601-5210                      |
| Holding torque                       |                 | N·m                                  | 1.4                              | 2.35         | 2.5          | 0.69                             |
| Rotor inertia                        |                 | × 10 <sup>-4</sup> kg·m <sup>2</sup> | 0.28                             | 0.5          | 0.6          | 0.24                             |
| Rated current                        |                 | A/phase                              | 2                                | 2            | 2            | 2                                |
| Motor mass <sup>(1)</sup>            |                 | kg                                   | 0.69                             | 1.1          | 1.27         | 0.55                             |
| Allowable thrust load                |                 | N                                    | 20                               | 20           | 20           | 15                               |
| Allowable radial load <sup>(2)</sup> |                 | N                                    | 102                              | 78           | 70           | 78                               |

(1) For the driver mass, see ▶ p. 26

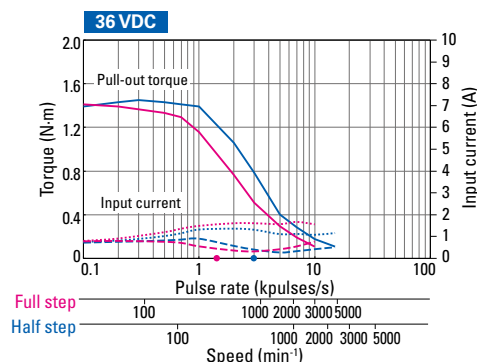
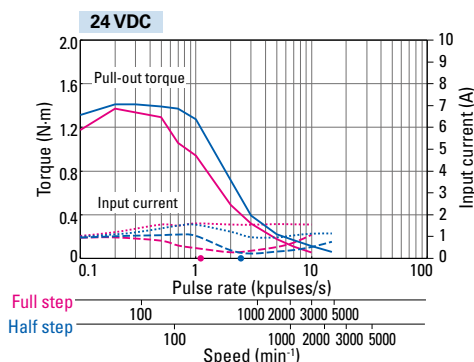
(2) Load is exerted to the shaft end.

### Characteristics

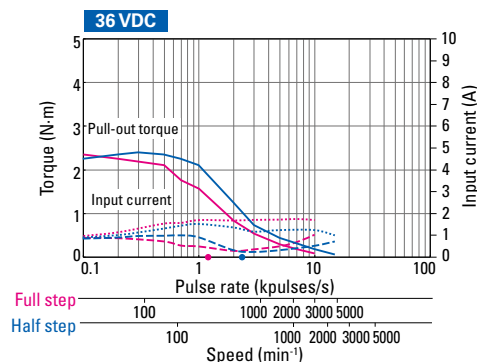
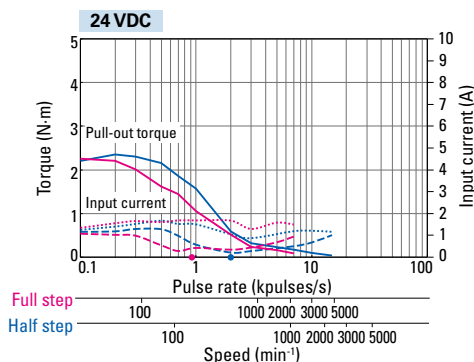
With rubber coupling used

Pull-out torque    Full step    Half step    fs: Maximum starting pulse rate with no load    Full step    Half step  
Input current (with no load)    Full step    Half step    Input current (with load)    Full step    Half step

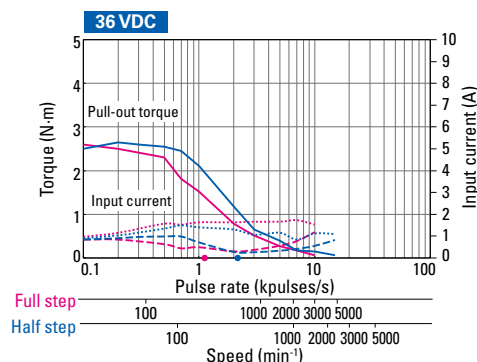
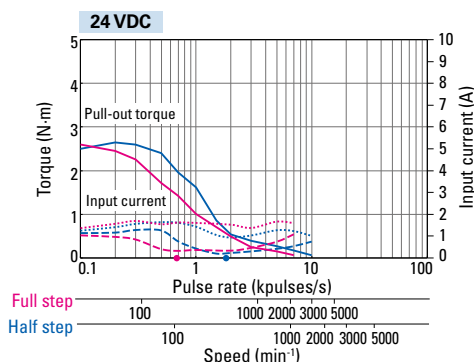
#### DB16M712S DB16M712D



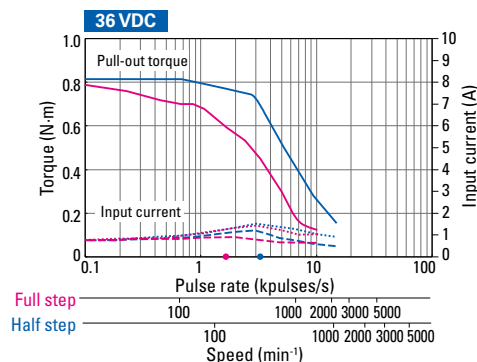
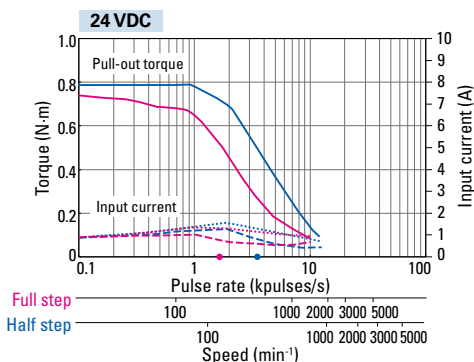
#### DB16M713S DB16M713D



#### DB16M714S DB16M714D



#### DB16S161S DB16S161D





|                                      |                                    |                                  |
|--------------------------------------|------------------------------------|----------------------------------|
| Size                                 | Motor size                         | 60 mm sq. (0.9° full step angle) |
|                                      | Motor length                       | 54 mm                            |
| Single shaft                         | Set order no.                      | DB16S162S                        |
|                                      | Motor model no.                    | SH1602-5240                      |
| Dual shaft                           | Set order no.                      | DB16S162D                        |
|                                      | Motor model no.                    | SH1602-5210                      |
| Holding torque                       | N·m                                | 1.28                             |
| Rotor inertia                        | $\times 10^{-4}$ kg·m <sup>2</sup> | 0.4                              |
| Rated current                        | A/phase                            | 2                                |
| Motor mass <sup>(1)</sup>            | kg                                 | 0.8                              |
| Allowable thrust load                | N                                  | 15                               |
| Allowable radial load <sup>(2)</sup> | N                                  | 65                               |

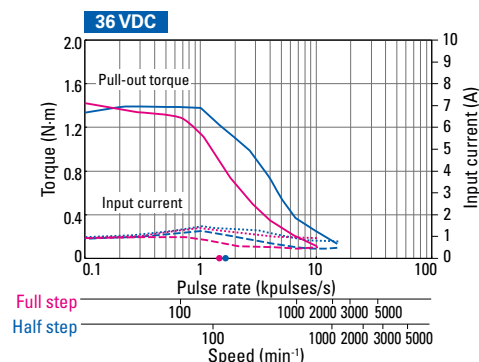
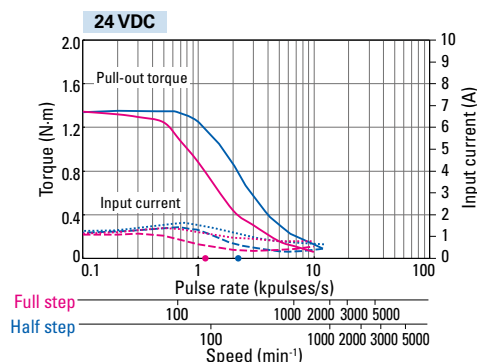
(1) For the driver mass, see ▶ p. 26

(2) Load is exerted to the shaft end.

## Characteristics

With rubber coupling used

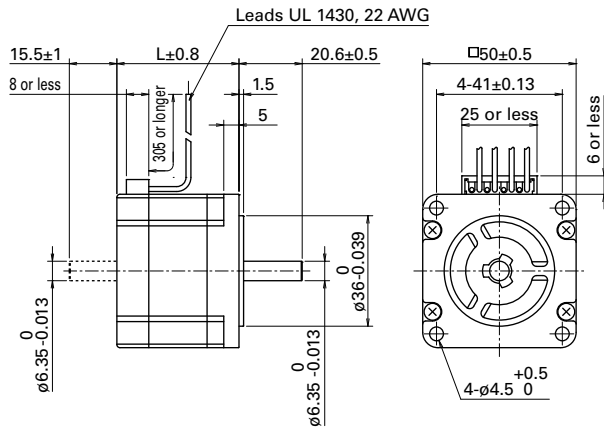
Pull-out torque    Full step —    Half step —    fs: Maximum starting pulse rate with no load    Full step ●    Half step ●  
Input current (with no load)    Full step - - -    Half step - - -    Input current (with load)    Full step .....    Half step .....

DB16S162S  
DB16S162D




# Stepping Motor Dimensions Unit: mm

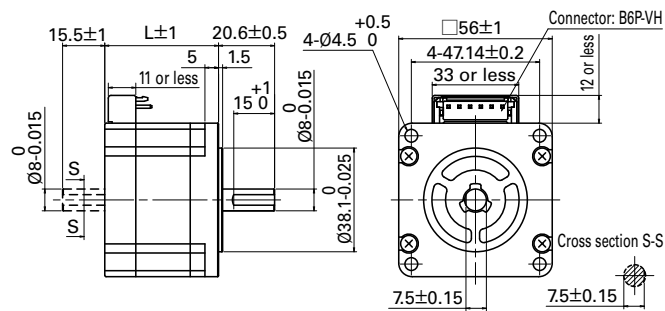
## 50 mm sq.



## Bipolar

| Set order no. |            | Motor model no. |               | Motor length (L) |
|---------------|------------|-----------------|---------------|------------------|
| Single shaft  | Dual shaft | Single shaft    | Dual shaft    |                  |
| DB16H671S     | DB16H671D  | 103H6701-5040   | 103H6701-5010 | 39.8             |
| DB16H673S     | DB16H673D  | 103H6703-5040   | 103H6703-5010 | 51.3             |

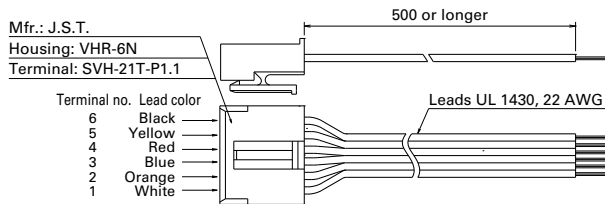
## 56 mm sq.



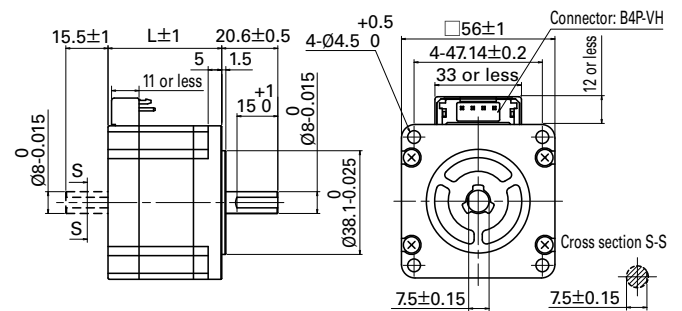
## Unipolar

| Set order no. |            | Motor model no. |              | Motor length (L) |
|---------------|------------|-----------------|--------------|------------------|
| Single shaft  | Dual shaft | Single shaft    | Dual shaft   |                  |
| DU16M711S     | DU16M711D  | SM2561C20U41    | SM2561C20U11 | 41.8             |
| DU16M712S     | DU16M712D  | SM2562C20U41    | SM2562C20U11 | 53.8             |
| DU16M713S     | DU16M713D  | SM2563C20U41    | SM2563C20U11 | 75.8             |
| DU16M714S     | DU16M714D  | SM2564C20U41    | SM2564C20U11 | 85.8             |

## Unipolar motor cable 4837798-1



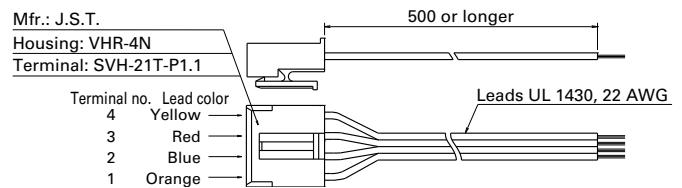
## 56 mm sq.



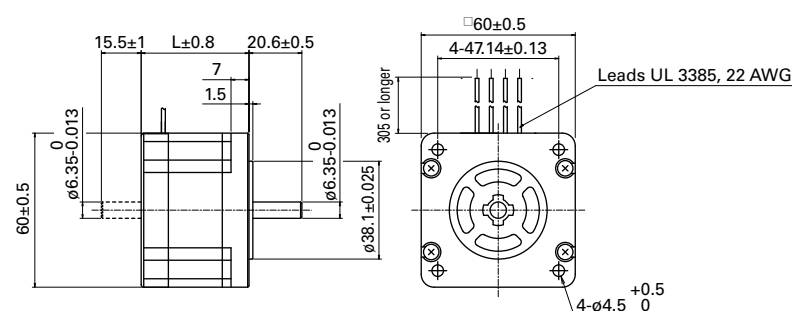
## Bipolar

| Set order no. |            | Motor model no. |              | Motor length (L) |
|---------------|------------|-----------------|--------------|------------------|
| Single shaft  | Dual shaft | Single shaft    | Dual shaft   |                  |
| DB16M711S     | DB16M711D  | SM2561C20B41    | SM2561C20B11 | 41.8             |
| DB16M712S     | DB16M712D  | SM2562C20B41    | SM2562C20B11 | 53.8             |
| DB16M713S     | DB16M713D  | SM2563C20B41    | SM2563C20B11 | 75.8             |
| DB16M714S     | DB16M714D  | SM2564C20B41    | SM2564C20B11 | 85.8             |

## Bipolar motor cable 4837961-1



## 60 mm sq.



## Bipolar

| Set order no. |            | Motor model no. |             | Motor length (L) |
|---------------|------------|-----------------|-------------|------------------|
| Single shaft  | Dual shaft | Single shaft    | Dual shaft  |                  |
| DB16S161S     | DB16S161D  | SH1601-5240     | SH1601-5210 | 42               |
| DB16S162S     | DB16S162D  | SH1602-5240     | SH1602-5210 | 54               |

# General Specifications of Stepping Motors

|                                                              |                                                                                                                                                                                                     |                                       |                                |                                                                                                                                                       |                                                                                                                                                       |                                                                                                                                                       |
|--------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------|--------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------|
| Motor model no.                                              | SH228 <input type="checkbox"/>                                                                                                                                                                      | SH142 <input type="checkbox"/>        | SF242 <input type="checkbox"/> | 103H670 <input type="checkbox"/>                                                                                                                      | SM256 <input type="checkbox"/>                                                                                                                        | SH160 <input type="checkbox"/>                                                                                                                        |
| Operation type                                               | —                                                                                                                                                                                                   |                                       |                                |                                                                                                                                                       |                                                                                                                                                       |                                                                                                                                                       |
| Operating ambient temperature                                | -10 to +50°C                                                                                                                                                                                        |                                       |                                |                                                                                                                                                       |                                                                                                                                                       |                                                                                                                                                       |
| Storage temperature                                          | -20 to +65°C                                                                                                                                                                                        |                                       |                                |                                                                                                                                                       |                                                                                                                                                       |                                                                                                                                                       |
| Operating ambient humidity                                   | 20 to 90% RH (non-condensing)                                                                                                                                                                       |                                       |                                |                                                                                                                                                       |                                                                                                                                                       |                                                                                                                                                       |
| Storage humidity                                             | 5 to 95 % RH (non-condensing)                                                                                                                                                                       |                                       |                                |                                                                                                                                                       |                                                                                                                                                       |                                                                                                                                                       |
| Operating altitude                                           | Up to 1000 m above sea level                                                                                                                                                                        |                                       |                                |                                                                                                                                                       |                                                                                                                                                       |                                                                                                                                                       |
| Vibration resistance                                         | Frequency 10 to 500 Hz, amplitude 1.52 mm (10 to 70 Hz), acceleration 150 m/s <sup>2</sup> (70 to 500 Hz), sweep time 15 min/cycle, 12 cycles for each of both directions in each X, Y, and Z axes. |                                       |                                |                                                                                                                                                       |                                                                                                                                                       |                                                                                                                                                       |
| Shock resistance                                             | Acceleration 500 m/s <sup>2</sup> , duration 11 ms, half sine wave, tested 3 times in both directions for each X, Y, and Z axis for a total of 18 times                                             |                                       |                                |                                                                                                                                                       |                                                                                                                                                       |                                                                                                                                                       |
| Thermal class                                                | B (+130°C)                                                                                                                                                                                          |                                       |                                |                                                                                                                                                       | B (+130°C)<br>(A for UL models)                                                                                                                       | B (+130°C)                                                                                                                                            |
| Dielectric strength                                          | No abnormality after application of 500 VAC at 50/60 Hz between the motor winding and motor frame for one minute at normal temperature and humidity.                                                |                                       |                                | No abnormality after application of 1000 VAC at 50/60 Hz between the motor winding and motor frame for one minute at normal temperature and humidity. | No abnormality after application of 1120 VAC at 50/60 Hz between the motor winding and motor frame for one minute at normal temperature and humidity. | No abnormality after application of 1000 VAC at 50/60 Hz between the motor winding and motor frame for one minute at normal temperature and humidity. |
| Insulation resistance                                        | 100 MΩ or more with a 500 VDC megger between the motor winding and motor frame at normal temperature and humidity.                                                                                  |                                       |                                |                                                                                                                                                       |                                                                                                                                                       |                                                                                                                                                       |
| Protection rating                                            | —                                                                                                                                                                                                   |                                       |                                |                                                                                                                                                       |                                                                                                                                                       |                                                                                                                                                       |
| Winding temperature rise                                     | 80 K or less (based on our own standard)                                                                                                                                                            |                                       |                                |                                                                                                                                                       |                                                                                                                                                       |                                                                                                                                                       |
| Positional accuracy tolerance                                | ± 0.09°                                                                                                                                                                                             | ± 0.054°                              | ± 0.09°                        |                                                                                                                                                       | ± 0.054°                                                                                                                                              | ± 0.054°                                                                                                                                              |
| Thrust play <sup>(1)</sup>                                   | 0.075 mm or less<br>(With a 1.5 N load)                                                                                                                                                             | 0.075 mm or less<br>(With a 5 N load) | 0.075 mm<br>(With a 5 N load)  | 0.075 mm<br>(With a 10 N load)                                                                                                                        | 0.075 mm<br>(With a 10 N load)                                                                                                                        | 0.075 mm<br>(With a 10 N load)                                                                                                                        |
| Radial play <sup>(2)</sup>                                   | 0.025 mm (With a 5 N load)                                                                                                                                                                          |                                       |                                |                                                                                                                                                       |                                                                                                                                                       |                                                                                                                                                       |
| Runout of shaft                                              | 0.025 mm                                                                                                                                                                                            |                                       |                                |                                                                                                                                                       |                                                                                                                                                       |                                                                                                                                                       |
| Concentricity of motor shaft and fitting part                | ø0.05 mm                                                                                                                                                                                            | ø0.05 mm                              | ø0.05 mm                       | ø0.075 mm                                                                                                                                             | ø0.075 mm                                                                                                                                             | ø0.075 mm                                                                                                                                             |
| Perpendicularity of mounting surface and motor shaft surface | 0.1 mm                                                                                                                                                                                              | 0.1 mm                                | 0.1 mm                         | 0.1 mm                                                                                                                                                | 0.1 mm                                                                                                                                                | 0.1 mm                                                                                                                                                |
| Motor mounting orientation                                   | Can be installed vertically or horizontally.                                                                                                                                                        |                                       |                                |                                                                                                                                                       |                                                                                                                                                       |                                                                                                                                                       |

(1) Thrust play: Shaft position displacement when a load is exerted in a direction parallel to the motor shaft.

(2) Radial play: Maximum shaft position displacement when a load is exerted in a direction perpendicular to the motor shaft. Load is exerted on the point 1/3 the shaft length from the shaft end.

## Safety standards

Model no.: SM256 ☐ UL models

|    | Classification      | Standards            | File no. |
|----|---------------------|----------------------|----------|
| UL | UL                  | UL 1004-1, UL 1004-6 | E179832  |
|    | UL for Canada (cUL) | CSA C22.2 No. 100    |          |

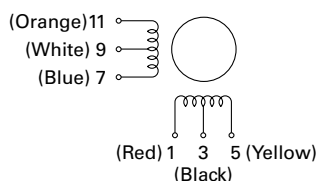
# Internal Wiring and Rotational Directions

## Unipolar winding

Connector type, model no.: SF242 ☐

### Internal wiring

In parentheses are lead colors of the motor cable



### Direction of motor rotation

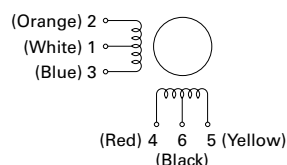
When excited by a direct current in the order shown below, the direction of rotation is clockwise as viewed from the output shaft side.

|                     |   | Connector pin no. |   |   |   |    |
|---------------------|---|-------------------|---|---|---|----|
|                     |   | 3, 9              | 1 | 7 | 5 | 11 |
| Excitation sequence | 1 | +                 | — | — |   |    |
|                     | 2 | +                 |   | — | — |    |
|                     | 3 | +                 |   |   | — | —  |
|                     | 4 | +                 | — |   |   | —  |

Connector type, model no.: SM256 ☐

### Internal wiring

In parentheses are lead colors of the motor cable



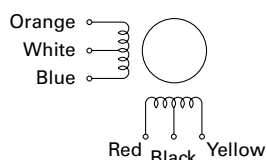
### Direction of motor rotation

When excited by a direct current in the order shown below, the direction of rotation is clockwise as viewed from the output shaft side.

|                     |   | Connector pin no. |   |   |   |   |
|---------------------|---|-------------------|---|---|---|---|
|                     |   | 1, 6              | 4 | 3 | 5 | 2 |
| Excitation sequence | 1 | +                 | — | — |   |   |
|                     | 2 | +                 |   | — | — |   |
|                     | 3 | +                 |   |   | — | — |
|                     | 4 | +                 | — |   |   | — |

Lead type

### Internal wiring



### Direction of motor rotation

When excited by a direct current in the order shown below, the direction of rotation is clockwise as viewed from the output shaft side.

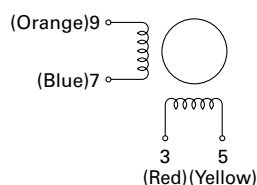
|                     |   | Lead color   |     |      |        |        |
|---------------------|---|--------------|-----|------|--------|--------|
|                     |   | White, Black | Red | Blue | Yellow | Orange |
| Excitation sequence | 1 | +            | —   | —    |        |        |
|                     | 2 | +            |     | —    | —      |        |
|                     | 3 | +            |     |      | —      | —      |
|                     | 4 | +            | —   |      |        | —      |

## Bipolar winding

Connector type, model no.: SF242 ☐

### Internal wiring

In parentheses are lead colors of the motor cable



### Direction of motor rotation

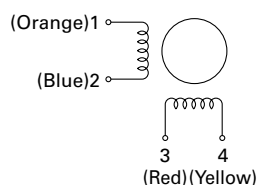
When excited by a direct current in the order shown below, the direction of rotation is clockwise as viewed from the output shaft side.

|                     |   | Connector pin no. |   |   |   |
|---------------------|---|-------------------|---|---|---|
|                     |   | 3                 | 7 | 5 | 9 |
| Excitation sequence | 1 | —                 | — | + | + |
|                     | 2 | +                 | — | — | + |
|                     | 3 | +                 | + | — | — |
|                     | 4 | —                 | + | + | — |

Connector type, model no.: SM256 ☐

### Internal wiring

In parentheses are lead colors of the motor cable



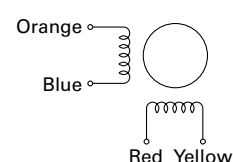
### Direction of motor rotation

When excited by a direct current in the order shown below, the direction of rotation is clockwise as viewed from the output shaft side.

|                     |   | Connector pin no. |   |   |   |
|---------------------|---|-------------------|---|---|---|
|                     |   | 3                 | 2 | 4 | 1 |
| Excitation sequence | 1 | —                 | — | + | + |
|                     | 2 | +                 | — | — | + |
|                     | 3 | +                 | + | — | — |
|                     | 4 | —                 | + | + | — |

Lead type

### Internal wiring



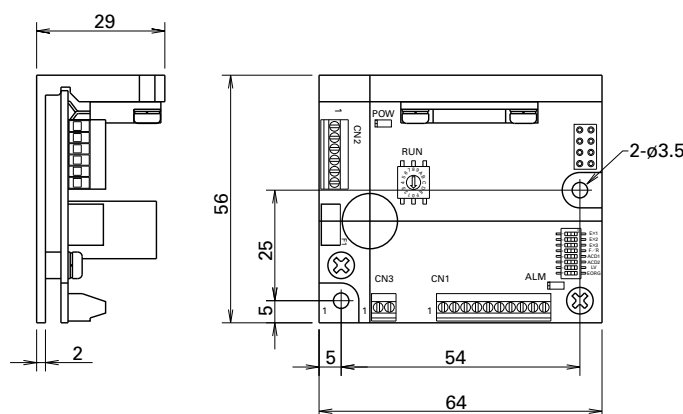
### Direction of motor rotation

When excited by a direct current in the order shown below, the direction of rotation is clockwise as viewed from the output shaft side.

|                     |   | Lead color |      |        |        |
|---------------------|---|------------|------|--------|--------|
|                     |   | Red        | Blue | Yellow | Orange |
| Excitation sequence | 1 | —          | —    | +      | +      |
|                     | 2 | +          | —    | —      | +      |
|                     | 3 | +          | +    | —      | —      |
|                     | 4 | —          | +    | +      | —      |

# Driver Dimensions

Unit: mm



# Driver Specifications

## General specifications

|                      |                             | Unipolar                                                                                                                                                                                | Bipolar                                                                                          |
|----------------------|-----------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------|
| Basic specifications | Model no.                   | US1D200P10                                                                                                                                                                              | BS1D200P10                                                                                       |
|                      | Input voltage               | 24/36 VDC $\pm$ 10%                                                                                                                                                                     |                                                                                                  |
|                      | Input current               | 3 A                                                                                                                                                                                     |                                                                                                  |
|                      | Environment                 | Protection class                                                                                                                                                                        | Class III                                                                                        |
|                      |                             | Operating environment                                                                                                                                                                   | Installation category (Overvoltage category): I, pollution level: 2                              |
|                      |                             | Operating ambient temperature                                                                                                                                                           | 0 to +50°C                                                                                       |
|                      |                             | Storage temperature                                                                                                                                                                     | -20 to +70°C                                                                                     |
|                      |                             | Operating ambient humidity                                                                                                                                                              | 35 to 85 % RH (non-condensing)                                                                   |
|                      |                             | Storage humidity                                                                                                                                                                        | 10 to 90% RH (non-condensing)                                                                    |
|                      |                             | Operating altitude                                                                                                                                                                      | Up to 1000 m above sea level                                                                     |
|                      |                             | Vibration resistance                                                                                                                                                                    | 5 m/s <sup>2</sup> freq. range 10 to 55 Hz tested for 2 hours in each X, Y and Z-axis directions |
|                      |                             | Shock resistance                                                                                                                                                                        | Not abnormality observed as per NDS-C-0110 section 3.2.2 category C.                             |
|                      |                             | Dielectric strength                                                                                                                                                                     | No error when applying 0.5 kVAC for a minute between power input terminal and chassis.           |
|                      |                             | Insulation resistance                                                                                                                                                                   | 10 MΩ or more with 500 VDC megger between power input terminal and chassis.                      |
|                      | Mass                        | 0.09 kg                                                                                                                                                                                 |                                                                                                  |
| Functions            | Mode selection              | Step angle mode, input pulse mode, low vibration mode, current at rest, operating current, initial excitation phase                                                                     |                                                                                                  |
|                      | Protective functions        | Open phase, main circuit power supply undervoltage                                                                                                                                      |                                                                                                  |
|                      | LED indicators              | Power supply monitoring, alarm indicator                                                                                                                                                |                                                                                                  |
| I/O signal           | Command pulse input signal  | Photocoupler input method; input resistance: 220 Ω, high-level input signal voltage: 4.0 to 5.5 V, low-level input signal voltage: 0 to 0.5 V, maximum starting pulse rate 150 pulses/s |                                                                                                  |
|                      | Power down input signal     | Photocoupler input method; input resistance: 220 Ω, high-level input signal voltage: 4.0 to 5.5 V, low-level input signal voltage: 0 to 0.5 V                                           |                                                                                                  |
|                      | Phase origin monitor output | Open-collector output through photo coupler, Vce: 40 V or less, Ic: 10 mA or less                                                                                                       |                                                                                                  |
|                      | Alarm output signal         | Open-collector output through photo coupler, Vce: 40 V or less, Ic: 10 mA or less                                                                                                       |                                                                                                  |

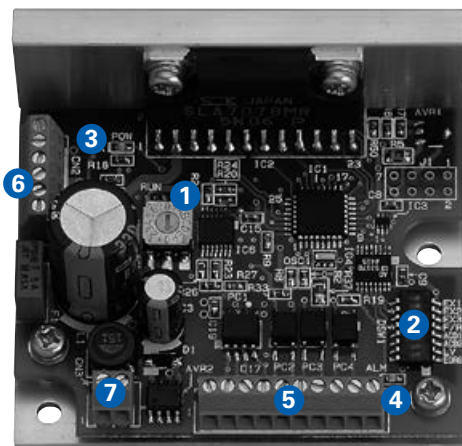
## Safety standards

| CE (TÜV)      | Directive             | Category     | Standards    | Name                                             |
|---------------|-----------------------|--------------|--------------|--------------------------------------------------|
|               | Low Voltage Directive | —            | EN 61010-1   | —                                                |
| EMC Directive | Emission              | EN 55011-A   | EN 55011-A   | Terminal disturbance voltage                     |
|               |                       |              | EN 55011-A   | Electromagnetic radiation disturbance            |
|               | Immunity              | EN 61000-4-2 | EN 61000-4-2 | ESD (Electrostatic discharge)                    |
|               |                       |              | EN 61000-4-3 | Radiated, radio-frequency, electromagnetic field |
|               |                       |              | EN 61000-4-4 | Fast transients/burst                            |
|               |                       |              | EN 61000-4-6 | Conducted disturbances                           |
| UL            | Classification        | Standards    | File no.     |                                                  |
|               | UL                    | UL 508C      | E179775      |                                                  |
|               | UL for Canada (cUL)   |              |              |                                                  |

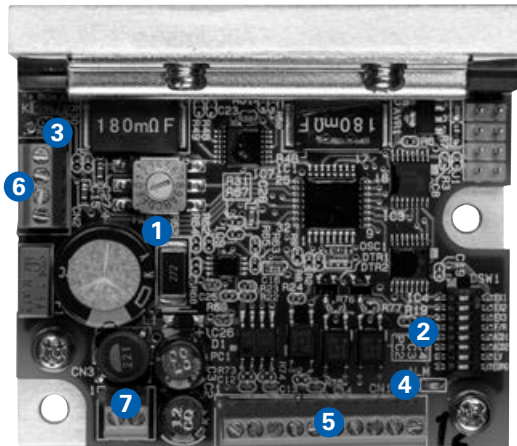
- Actual EMC levels vary depending on the configuration of the users' control panel where a driver and stepping motor are built in, and the placement layout of other electrical devices and wiring. EMC noise solution parts such as noise filters and toroidal type ferrite cores may be required in some cases.
- Validation test of drivers was performed as per Low-Voltage and EMC Directives at TÜV (TÜV product service) for self-declaration of CE marking.
- Drivers can be purchased not only as a set but also as a single item. Connector-type drivers are also available. Contact us for details.

# Driver Part Names and Functions

Unipolar



Bipolar



## 1 Operating current selection switch (RUN)

The value of the motor operating current can be set with a rotary switch.

| Dial              | 0   | 1   | 2   | 3   | 4   | 5   | 6   | 7   |
|-------------------|-----|-----|-----|-----|-----|-----|-----|-----|
| Motor current (A) | 2.0 | 1.9 | 1.8 | 1.7 | 1.6 | 1.5 | 1.4 | 1.3 |
| Dial              | 8   | 9   | A   | B   | C   | D   | E   | F   |
| Motor current (A) | 1.2 | 1.1 | 1.0 | 0.9 | 0.8 | 0.7 | 0.6 | 0.5 |

• The factory setting is F (0.5 A). Select the operating current after checking the rated current of the combination motor.

## 2 Function selection DIP switchpack

Functions can be selected to suit your application.

Factory settings

|      | OFF                      | ON                       |                                         |
|------|--------------------------|--------------------------|-----------------------------------------|
| EX1  | <input type="checkbox"/> | <input type="checkbox"/> | 8 subdivisions                          |
| EX2  | <input type="checkbox"/> | <input type="checkbox"/> |                                         |
| EX3  | <input type="checkbox"/> | <input type="checkbox"/> |                                         |
| F/R  | <input type="checkbox"/> | <input type="checkbox"/> | 2-input mode (CW, CCW pulse input)      |
| ACD1 | <input type="checkbox"/> | <input type="checkbox"/> | Current at rest: 40% of driving current |
| ACD2 | <input type="checkbox"/> | <input type="checkbox"/> |                                         |
| LV   | <input type="checkbox"/> | <input type="checkbox"/> | Microstepping                           |
| EORG | <input type="checkbox"/> | <input type="checkbox"/> | Phase origin                            |

### 1. Step angle selection (EX1, EX2, EX3)

Number of full step angle subdivisions can be selected.

| EX1 | EX2 | EX3 | Microsteps      |
|-----|-----|-----|-----------------|
| ON  | ON  | ON  | 1 subdivision   |
| OFF | ON  | OFF | 2 subdivisions  |
| ON  | OFF | OFF | 4 subdivisions  |
| OFF | OFF | OFF | 8 subdivisions  |
| OFF | OFF | ON  | 16 subdivisions |

### 2. Input mode selection (F/R)

Input pulse mode can be selected.

| F/R | Input pulse mode       |
|-----|------------------------|
| ON  | 1-input mode (CK, U/D) |
| OFF | 2-input mode (CW, CCW) |

### 3. Current selection when stopping (ACD1, ACD2)

Select the current value of the motor when stopping.

| ACD2 | ACD1 | Motor current           |
|------|------|-------------------------|
| ON   | ON   | 100% of driving current |
| ON   | OFF  | 60% of driving current  |
| OFF  | ON   | 50% of driving current  |
| OFF  | OFF  | 40% of driving current  |

• Initial factory setting is 40% of the rated value. Driver and motor should be operated at around 50% of rated value to reduce heat.

## 4. Low vibration mode select (LV)

Motors can smoothly operate even at low resolution settings such as full-step (1 subdivision) and half-step (2 subdivisions) modes.

| LV  | Initial excitation phase |
|-----|--------------------------|
| ON  | Low vibration            |
| OFF | Microstepping            |

## 5. Excitation selection (EORG)

The excitation phase at the time of power activation is selected.

| EORG | Initial excitation phase           |
|------|------------------------------------|
| ON   | Excitation phase at power shutdown |
| OFF  | Phase origin                       |

• By turning on EORG, the excitation phase at the time of power shutdown will be saved. Therefore, there will be no shaft displacement when the power is turned on next time.

## 3 Power supply monitoring LED (POW)

Lights up when the main circuit power supply is turned on.

## 4 Alarm indicator LED (ALM)

The LED lights up in either of the followings:

- Motor cable is damaged
- The switching device in the driver is damaged
- The main circuit power supply voltage is outside the specification range (below 19 VDC).

When "ALM" is lit, the winding current of the stepping motor is cut off and the status will shift to a "non-excitation" state. At the same time, an output signal (photocoupler ON) is transmitted from the alarm output terminal (AL) to outside. When the alarm circuit is activated, this state is maintained until it is reset by turning on the power supply again. When an alarm goes off, please take corrective actions to eliminate the cause of the alarm before turning on the power supply again.

## 5 I/O signal terminals (CN1)

For input/output signal connections.

## 6 Motor connection terminals (CN2)

For motor power connection.

## 7 Power supply connection terminals (CN3)

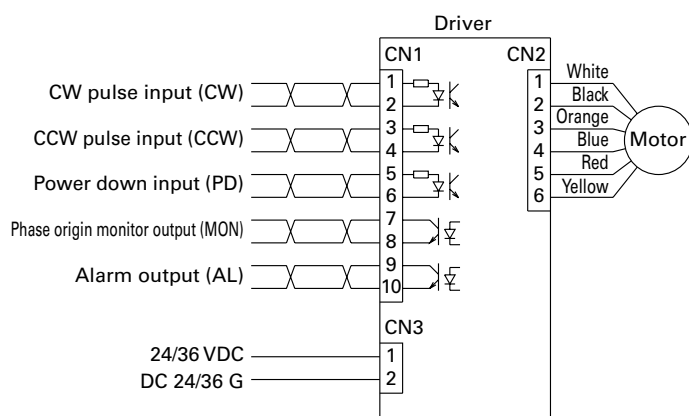
For main circuit power supply connection.



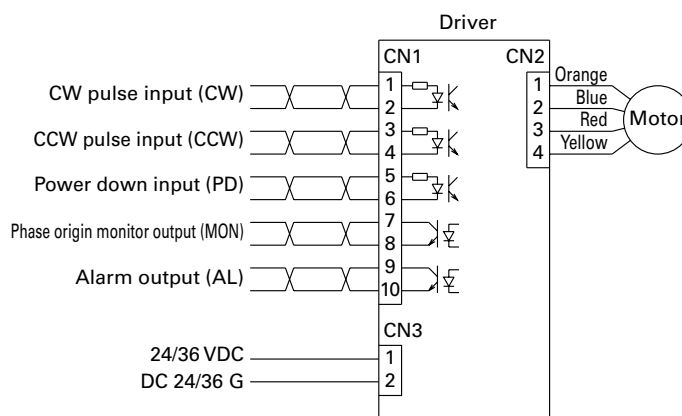
# Connections and Signals

## External wiring diagram

### Unipolar



### Bipolar



## Cable size

| Type             | Cable Size                                                     | Maximum length |
|------------------|----------------------------------------------------------------|----------------|
| Power cable      | 22 AWG (0.3 mm <sup>2</sup> )                                  | 2 m or less    |
| I/O signal cable | 24 AWG (0.2 mm <sup>2</sup> ) to 22 AWG (0.3 mm <sup>2</sup> ) | 2 m or less    |
| Motor cable      | 22 AWG (0.3 mm <sup>2</sup> )                                  | Below 3 m      |

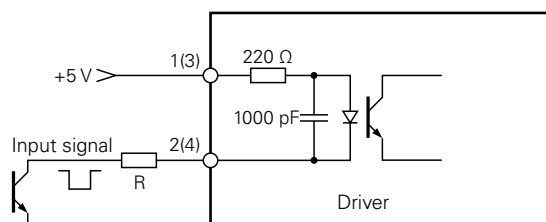
## Input/output signal specification overview

| Signal                            | CN1 Pin no. | Function overview                                                                                                                                                                                                                         |
|-----------------------------------|-------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| CW pulse input (CW) (Standard)    | 1<br>2      | When in 2-input mode, a CW-direction pulse is input.                                                                                                                                                                                      |
| Drive pulse input (CK)            | 1<br>2      | When in 1-input mode, a drive pulse is input to rotate the motor.                                                                                                                                                                         |
| CCW pulse input (CCW) (Standard)  | 3<br>4      | When in 2-input mode, a CCW-direction pulse is input.                                                                                                                                                                                     |
| Rotational direction input (U/D)  | 3<br>4      | When in 1-input mode, a drive pulse is input to designate the rotational direction.<br>Internal photocoupler ON ... CW direction<br>Internal photocoupler OFF ... CCW direction                                                           |
| Power down input (PD)             | 5<br>6      | A PD signal input will cut off (power off) the current flowing to the motor.<br>PD input signal on (internal photocoupler on) ... PD function is enabled.<br>PD input signal off (internal photocoupler off) ... PD function is disabled. |
| Phase origin monitor output (MON) | 7<br>8      | Turned on when the excitation phase is at the origin (when power is turned on).<br>In full step mode, turned on once for 4 pulses.<br>In half step mode, turned on once for 8 pulses.                                                     |
| Alarm output (AL)                 | 9<br>10     | When the alarm circuit is activated inside the driver, an alarm signal (photocoupler on) is output to outside, which turns the stepping motor to non-excited state.                                                                       |

Note: The CW direction refers to the clockwise direction when the motor is viewed from the output shaft side.

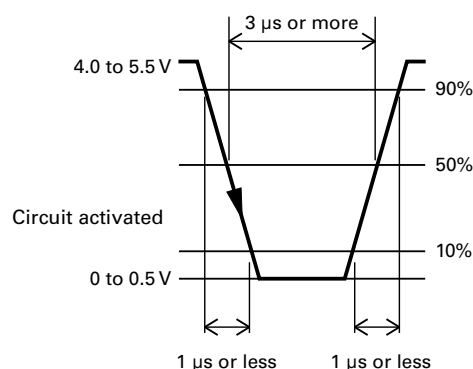
The CCW direction refers to the counter-clockwise direction when the motor is viewed from the output shaft side.

## Circuit Configuration of Pulse Input CW (CK), CCW (U/D)



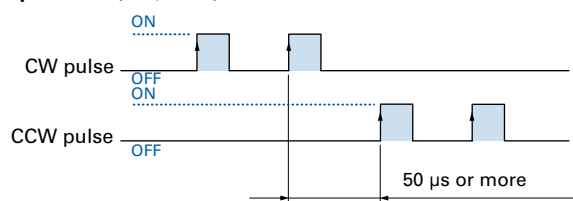
- Ensure that the pulse duty is 50% or less.
- Maximum starting pulse rate is 150 pulses/s.
- If the peak voltage of the input signal exceeds 5.5 V, add an external current-limiting resistor R to limit the input current to around 15 mA. (Take the photocoupler forward voltage of 1.5 V into consideration.)

### Input signal specifications



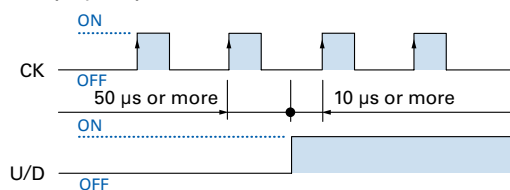
### Command pulse timing

#### 2-input mode (CW, CCW)



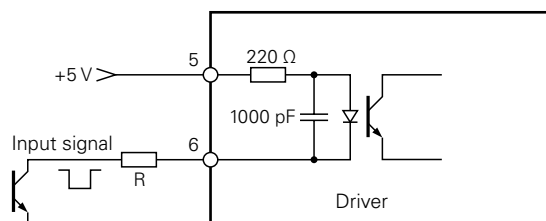
- Shaded areas indicate that internal photocoupler is ON. Internal circuit (motor) starts operating at leading edge of the photocoupler ON.
- When applying a pulse to CW, set the CCW side internal photocoupler to OFF.
- When applying a pulse to CCW, set the CW side internal photocoupler to OFF.

#### 1-input mode (CK, U/D)



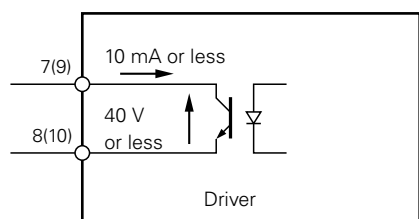
- Shaded areas indicate that internal photocoupler is ON. Internal circuit (motor) starts operating at leading edge of the CK-side photocoupler ON.
- Switching of U/D input signal must be done while the CK-side internal photocoupler is OFF.

## Circuit Configuration of Power Down (PD) Input

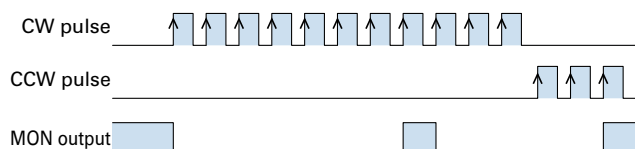


- If the peak voltage of the input signal exceeds 5.5 V, add an external current-limiting resistor R to limit the input current to around 15 mA. (Take the photocoupler forward voltage of 1.5 V into consideration.)

## Circuit Configuration of Phase Origin Monitor Output (MON) and Alarm Output (AL)



#### MON output



- Photo coupler is turned on when the motor's excitation phase is at the origin (when power is turned on).
- MON output is output every 7.2° rotation of the motor output shaft from the phase origin. (The figure on the left is for when the step angle setting is in a half-step mode)



# Stepping Motors (Single Items)

Stepping Motors

► p. 36–

IP65-Rated Stepping Motors

Water and dust protection

► p. 72–

In-Vacuum Stepping Motors

Custom product

► p. 77

Synchronous Motors

Custom product

► p. 77

## How to Read Specifications

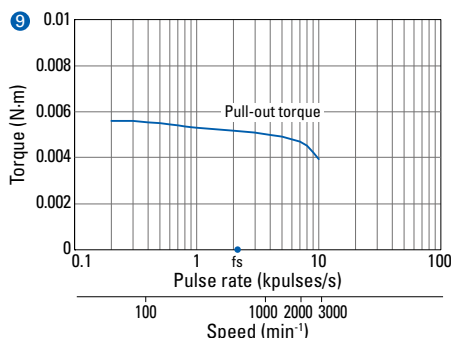
### Bipolar, lead type

| 1 Model no.  | 2 Holding torque at 2-phase excitation | 3 Rated current | 4 Winding resistance | 5 Winding inductance | 6 Rotor inertia                          | 7 Mass | 8 Motor length (L) |
|--------------|----------------------------------------|-----------------|----------------------|----------------------|------------------------------------------|--------|--------------------|
| Single shaft | N·m or more                            | A/phase         | Ω/phase              | mH/phase             | $\times 10^{-4}\text{kg}\cdot\text{m}^2$ | kg     | mm                 |
| SH2141-5541  | 0.0065                                 | 0.3             | 21                   | 4.2                  | 0.00058                                  | 0.03   | 30                 |
| SH2145-5641  | 0.01                                   | 0.4             | 19                   | 4                    | 0.0011                                   | 0.042  | 43.8               |

### Characteristics

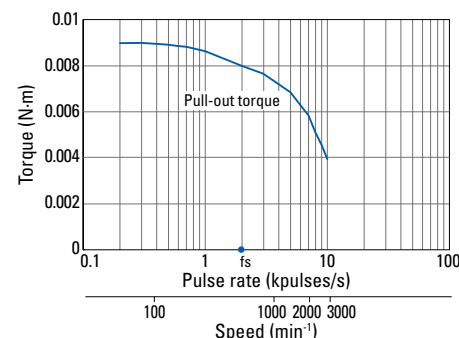
#### SH2141-5541 SH2141-5511

Constant current circuit  
Input voltage: 24 VDC  
Winding current:  
0.3 A/phase  
2-phase excitation (full step)  
Pull-out torque:  
 $J_L = 0.01 \times 10^{-4}\text{kg}\cdot\text{m}^2$   
(Pulley balancer method)  
 $f_s$ : Maximum starting pulse  
rate with no load



#### SH2145-5641 SH2145-5611

Constant current circuit  
Input voltage: 24 VDC  
Winding current:  
0.4 A/phase  
At 2-phase excitation (full step)  
Pull-out torque:  
 $J_L = 0.01 \times 10^{-4}\text{kg}\cdot\text{m}^2$   
(Pulley balancer method)  
 $f_s$ : Maximum starting pulse  
rate with no load



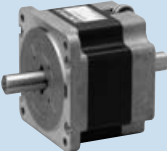
- This is the model number of the stepping motor.
- This is the maximum torque that is generated when the stepping motor is rotated by exerting an external force on the shaft at 2-phase excitation at the rated current.
- This is the rated current that flows to the motor winding. When current of this value flows through a motor, the torque generated will be the same as the holding torque.
- This is the resistance for one phase of stepping motor winding.

- This is the inductance for one phase of stepping motor winding.
- This is the moment of inertia of the rotor. This indicates the degree of ease with which the rotor accelerates or decelerates.
- This is the mass of the stepping motor.
- This is the length of the stepping motor.
- This graph shows the relationship between the pulse rate (frequency), motor speed, and pull-out torque in a full-step mode.

# Lineup

## Stepping Motors RoHS

These motors can be purchased as a single item.

| Full step angle | Motor size                              |                                                                                     | Holding torque [N·m]<br>Model no. | Custom options *                                                                                                       | Page        |
|-----------------|-----------------------------------------|-------------------------------------------------------------------------------------|-----------------------------------|------------------------------------------------------------------------------------------------------------------------|-------------|
| 1.8°            | 14 mm sq.<br><span>Ultra-compact</span> |    | 0.0065 to 0.01<br>SH214□-5□□1     | <span>Hollow shaft</span><br><span>Custom shaft</span>                                                                 | p. 36       |
|                 | 28 mm sq.                               |    | 0.055 to 0.145<br>SH228□-5□□1     | <span>Hollow shaft</span><br><span>Custom shaft</span><br><span>Gear</span> <span>Encoder</span>                       | p. 37 to 38 |
|                 | 35 mm sq.                               |    | 0.12 to 0.32<br>SH35□□-1□□□0      | <span>Hollow shaft</span><br><span>Custom shaft</span>                                                                 | p. 39 to 40 |
| 0.9°            | 42 mm sq.                               |    | 0.2 to 0.48<br>SH142□-□□□1        | <span>Hollow shaft</span><br><span>Custom shaft</span><br><span>Gear</span> <span>Encoder</span>                       | p. 41 to 42 |
| 1.8°            | 42 mm sq.<br><span>Thin-profile</span>  |    | 0.083 to 0.186<br>SS242□-50□□□    | <span>Hollow shaft</span><br><span>Custom shaft</span><br><span>Encoder</span>                                         | p. 43       |
|                 | 42 mm sq.                               |   | 0.22 to 0.8<br>SF242□-1□□□1       | <span>Custom shaft</span> <span>Gear</span><br><span>Encoder</span> <span>Brake</span>                                 | p. 44 to 45 |
|                 | 50 mm sq.                               |  | 0.28 to 0.53<br>103H670□-□□□0     | <span>Hollow shaft</span><br><span>Custom shaft</span><br><span>Encoder</span>                                         | p. 46 to 48 |
|                 | 50 mm sq.<br><span>Thin-profile</span>  |  | 0.1 to 0.215<br>SS250□-80□□0      | <span>Hollow shaft</span><br><span>Custom shaft</span>                                                                 | p. 49       |
|                 | 56 mm sq.<br><span>UL models</span>     |  | 0.53 to 2.5<br>SM256□C□0□□1       | <span>Hollow shaft</span><br><span>Custom shaft</span><br><span>Gear</span> <span>Encoder</span><br><span>Brake</span> | p. 50 to 55 |
|                 | 60 mm sq.                               | It is recommended you use a 56 mm sq. motor (SM256 □ C □ 0 □ □ 1).                  |                                   |                                                                                                                        | p. 55       |
| 0.9°            | 60 mm sq.                               |  | 0.57 to 2.15<br>SH160□-□□□0       | <span>Hollow shaft</span><br><span>Custom shaft</span><br><span>Gear</span> <span>Encoder</span>                       | p. 56 to 57 |
| 1.8°            | 86 mm sq.                               |  | 2.5 to 9<br>SH286□-□□□1           | <span>Hollow shaft</span><br><span>Custom shaft</span><br><span>Encoder</span> <span>Brake</span>                      | p. 58 to 61 |

\* Custom options vary depending on the model number and quantity. Contact us for details.

\* Custom options vary depending on the model number and quantity. Contact us for details.

## RoHS

## Custom product

## Custom product

33

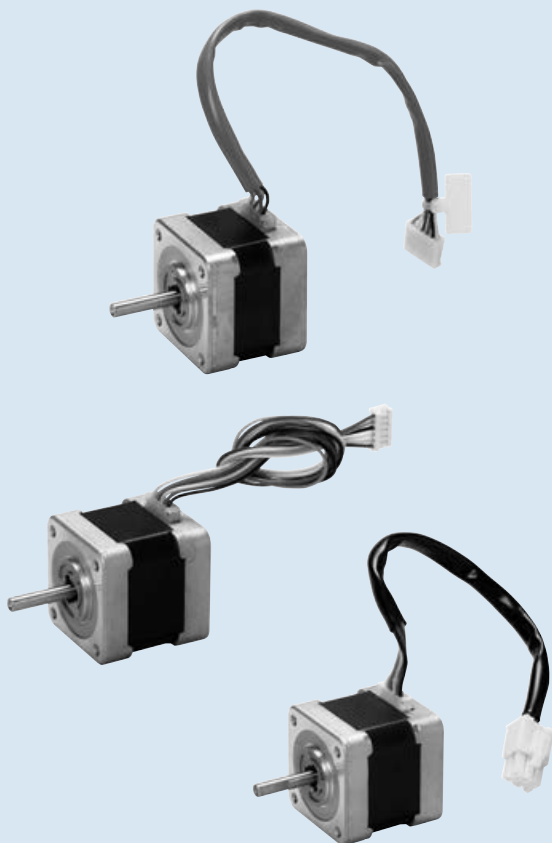
## Customization Services

Custom options availability varies depending on the requested customization and quantity. Contact us for details.

### Custom examples

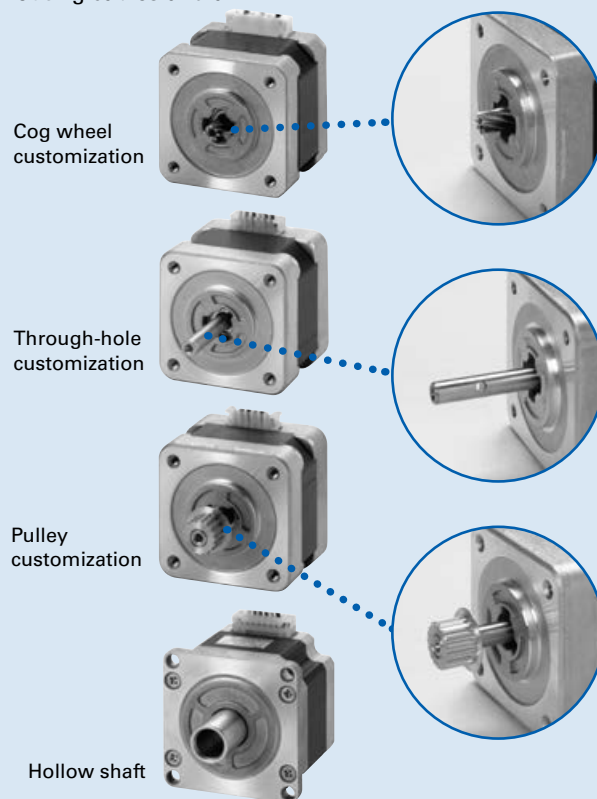
#### Custom harness

Connectors, cable ties, and plastic tubing can be added.



#### Custom shaft

We also offer custom options such as D-shaped shaft, addition of keyway and through-holes, and mounting of gear and pulley. The shaft can be made a hollow shaft for routing cables and air.



#### Rotary damper and surface mount damper

A damper can be added to reduce vibrations when rotating.



Rotary damper



Surface mount damper

#### Gears, encoders, and brake

- A gear can be added for applications where a high load torque is exerted at low speeds.
- An encoder can be added for detecting motor position and speed.
- A brake can be added to hold the motor position at rest.



With encoder



With gear



## Geared Motors

Applicable motor size: 56 mm sq. Model: S□2561

### Low backlash gear model

These models feature low-backlash gear.

|                        |                   |       |       |      |      |      |      |
|------------------------|-------------------|-------|-------|------|------|------|------|
| Allowable torque       | N·m               | 1.25  | 2.5   | 3    | 3.5  | 4    | 4    |
| Gear ratio             | —                 | 1:3.6 | 1:7.2 | 1:10 | 1:20 | 1:30 | 1:36 |
| Backlash               | ° or less         | 0.55  | 0.25  | 0.25 | 0.17 | 0.17 | 0.17 |
| Allowable speed        | min <sup>-1</sup> | 500   | 250   | 180  | 90   | 60   | 50   |
| Allowable thrust load  | N                 | 30    | 30    | 30   | 30   | 30   | 30   |
| Allowable radial load* | N                 | 100   | 100   | 100  | 100  | 100  | 100  |

\* Load is exerted on the point 1/3 the shaft length from the shaft end.

Note: The motor and shaft rotate in the same direction for 1:3.6 and 1:7.2 gear ratios and in opposite directions for 1:10, 1:20, 1:30, 1:36 gear ratios.

### Harmonic gear model

This model has extremely low backlash and superb positioning precision. The lineup has high gear ratios of up to 1:100 available.

|                         |                   |                         |                          |
|-------------------------|-------------------|-------------------------|--------------------------|
| Allowable torque        | N·m               | 5.5                     | 8                        |
| Peak torque             | N·m               | 14                      | 20                       |
| Gear ratio              | —                 | 1:50                    | 1:100                    |
| Lost motion             | arcmin            | 0.4 to 3 (at ±0.28 N·m) | 0.4 to 1.5 (at ±0.4 N·m) |
| Allowable speed         | min <sup>-1</sup> | 70                      | 35                       |
| Maximum allowable speed | min <sup>-1</sup> | 100                     | 50                       |
| Allowable thrust load   | N                 | 400                     | 400                      |
| Allowable radial load*  | N                 | 360                     | 360                      |

\* Load is exerted on the point 1/3 the shaft length from the shaft end.

Note: The motor shaft and the gear output shaft rotate in the opposite directions.



## Electromagnetic brake models

Compatible motors: 56 mm sq. Model no. SF256□ Note: Non-UL certified

The non-excitation electromagnetic brake holds a workpiece when power is lost, preventing it from falling.

|                        |               |                     |
|------------------------|---------------|---------------------|
| Brake activation type  | —             | Non-excitation type |
| Input voltage          | —             | 24 VDC ± 5%         |
| Power consumption      | W             | 6 (at 75° C)        |
| Static friction torque | N · m or more | 0.8                 |
| Polarity               | —             | Red: +, black: -    |



## Models with encoder

Compatible motors: 56 mm sq. Model no. SF256□

This model can detect vibration and step-out by monitoring the motor's operation status such as position and speed.

|                            |            |                    |          |          |
|----------------------------|------------|--------------------|----------|----------|
| Microsteps                 | P/R        | 1000               | 2000     | 4000     |
| Number of channels         | Ch         | 3                  | 3        | 3        |
| Output circuit             | —          | Line driver (CMOS) |          |          |
| Maximum response frequency | kHz        | 55                 | 110      | 220      |
| Input voltage              | —          | 5 V ± 5%           | 5 V ± 5% | 5 V ± 5% |
| Current consumption        | mA or less | 100                | 100      | 100      |



Contact us for information on motors other than 56 mm sq. motors.

# Stepping Motors

Allowable loads... ▶ p. 69

Internal wiring and rotational directions... ▶ p. 70

General specifications... ▶ p. 71



## 14 mm sq.

1.8°/step **Ultra-compact** **RoHS**

Bipolar, lead type

**Custom options****Hollow shaft** **Custom shaft**

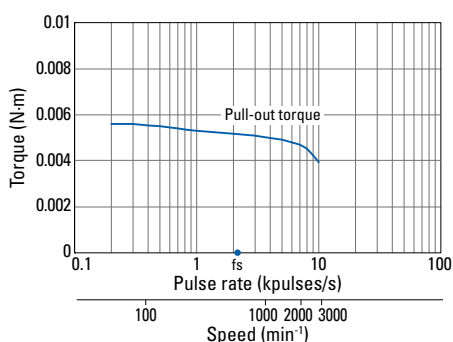
Note: Customization feasibility depends on the model number and quantity. Contact us for details.

**Bipolar, lead type**

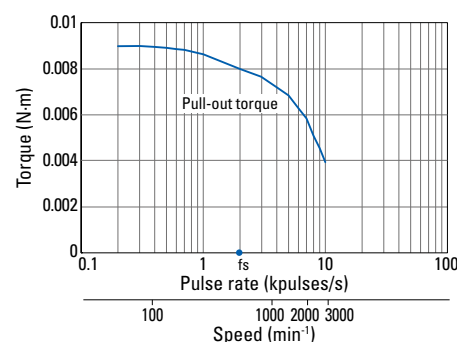
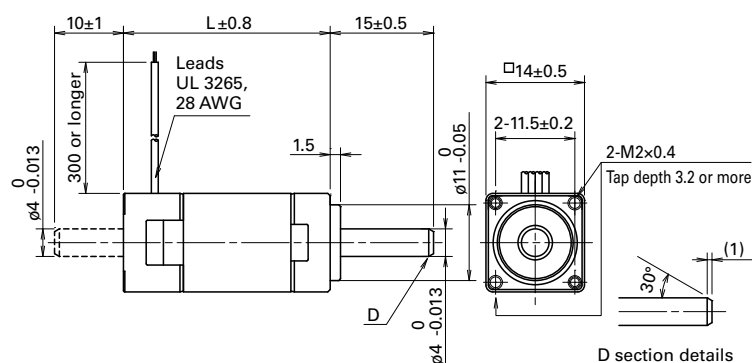
| Model no.          |                    | Holding torque<br>at 2-phase excitation | Rated<br>current | Winding<br>resistance | Winding inductance | Rotor inertia                       | Mass  | Motor<br>length (L) |
|--------------------|--------------------|-----------------------------------------|------------------|-----------------------|--------------------|-------------------------------------|-------|---------------------|
| Single shaft       | Dual shaft         | N·m or more                             | A/phase          | Ω/phase               | mH/phase           | ×10 <sup>-4</sup> kg·m <sup>2</sup> | kg    | mm                  |
| <b>SH2141-5541</b> | <b>SH2141-5511</b> | 0.0065                                  | 0.3              | 21                    | 4.2                | 0.00058                             | 0.03  | 30                  |
| <b>SH2145-5641</b> | <b>SH2145-5611</b> | 0.01                                    | 0.4              | 19                    | 4                  | 0.0011                              | 0.042 | 43.8                |

**Characteristics****SH2141-5541  
SH2141-5511**

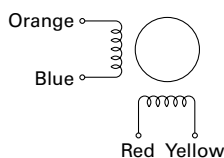
Constant current circuit  
Input voltage: 24 VDC  
Winding current:  
0.3 A/phase  
2-phase (full step)  
Pull-out torque:  
 $J_L = 0.01 \times 10^{-4} \text{kg} \cdot \text{m}^2$   
(Pulley balancer method)  
fs: Maximum starting pulse  
rate with no load

**SH2145-5641  
SH2145-5611**

Constant current circuit  
Input voltage: 24 VDC  
Winding current:  
0.4 A/phase  
At 2-phase excitation (full  
step)  
Pull-out torque:  
 $J_L = 0.01 \times 10^{-4} \text{kg} \cdot \text{m}^2$   
(Pulley balancer method)  
fs: Maximum starting pulse  
rate with no load

**Dimensions (Unit: mm)**

D section details

**Internal wiring****Compatible drivers**

A driver is to be provided by the customer.



# 28 mm sq.

1.8°/step **RoHS**

Unipolar, lead type  
Bipolar, lead type ▶ p. 38



Custom options

Hollow shaft Custom shaft  
Gear Encoder

Note: Customization feasibility depends on the model number and quantity. Contact us for details.

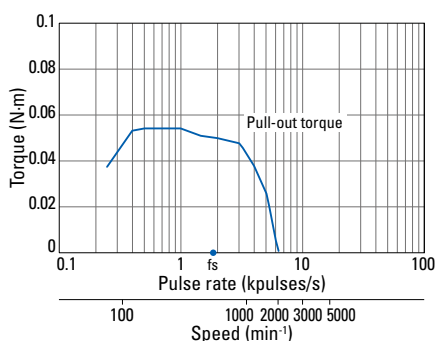
## Unipolar, lead type

| Model no.    |             | Holding torque<br>at 2-phase excitation | Rated<br>current | Winding<br>resistance | Winding inductance | Rotor inertia                       | Mass | Motor<br>length (L) |
|--------------|-------------|-----------------------------------------|------------------|-----------------------|--------------------|-------------------------------------|------|---------------------|
| Single shaft | Dual shaft  | N·m or more                             | A/phase          | Ω/phase               | mH/phase           | ×10 <sup>-4</sup> kg·m <sup>2</sup> | kg   | mm                  |
| SH2281-5171  | SH2281-5131 | 0.055                                   | 0.5              | 10.5                  | 3.7                | 0.01                                | 0.11 | 32                  |
| SH2281-5271  | SH2281-5231 | 0.055                                   | 1                | 2.85                  | 1                  | 0.01                                | 0.11 | 32                  |
| SH2285-5171  | SH2285-5131 | 0.115                                   | 0.5              | 17                    | 7                  | 0.022                               | 0.2  | 51.5                |
| SH2285-5271  | SH2285-5231 | 0.115                                   | 1                | 4.1                   | 1.9                | 0.022                               | 0.2  | 51.5                |

## Characteristics

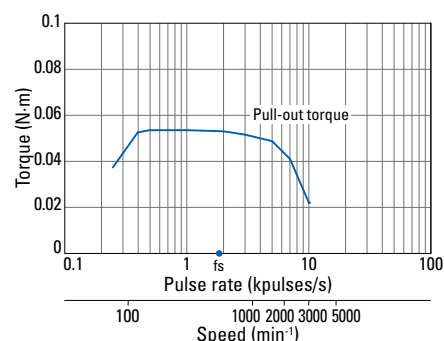
### SH2281-5171 SH2281-5131

Constant current circuit  
Input voltage: 24 VDC  
Winding current:  
0.5 A/phase  
At 2-phase excitation (full  
step)  
Pull-out torque:  
 $J_L = 0.01 \times 10^{-4} \text{kg} \cdot \text{m}^2$   
(Pulley balancer method)  
 $f_s$ : Maximum starting pulse  
rate with no load



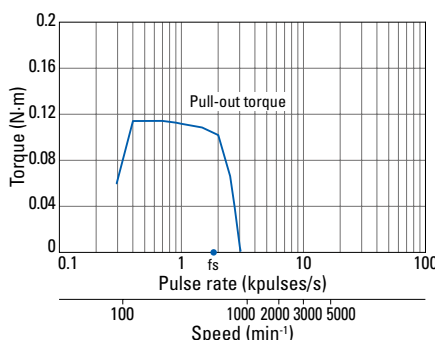
### SH2281-5271 SH2281-5231

Constant current circuit  
Input voltage: 24 VDC  
Winding current:  
1 A/phase  
At 2-phase excitation (full  
step)  
Pull-out torque:  
 $J_L = 0.01 \times 10^{-4} \text{kg} \cdot \text{m}^2$   
(Pulley balancer method)  
 $f_s$ : Maximum starting pulse  
rate with no load



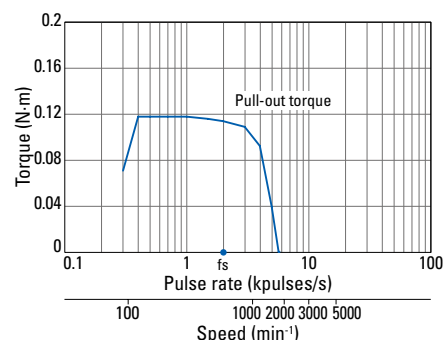
### SH2285-5171 SH2285-5131

Constant current circuit  
Input voltage: 24 VDC  
Winding current:  
0.5 A/phase  
At 2-phase excitation (full  
step)  
Pull-out torque:  
 $J_L = 0.01 \times 10^{-4} \text{kg} \cdot \text{m}^2$   
(Pulley balancer method)  
 $f_s$ : Maximum starting pulse  
rate with no load

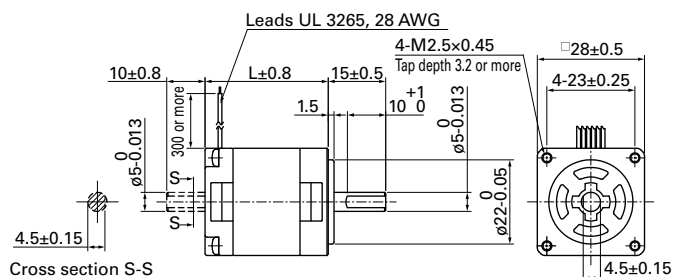


### SH2285-5271 SH2285-5231

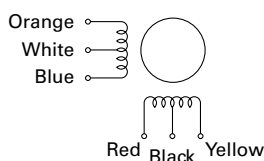
Constant current circuit  
Input voltage: 24 VDC  
Winding current:  
1 A/phase  
At 2-phase excitation (full  
step)  
Pull-out torque:  
 $J_L = 0.01 \times 10^{-4} \text{kg} \cdot \text{m}^2$   
(Pulley balancer method)  
 $f_s$ : Maximum starting pulse  
rate with no load



## Dimensions (Unit: mm)



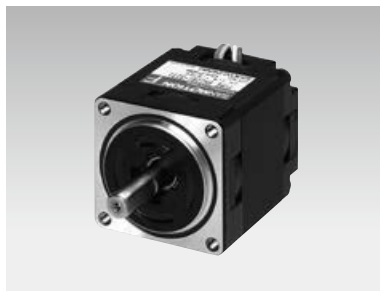
## Internal winding



## Compatible drivers

- For motors SH228 □ -52 □ 1 (1 A/phase)...  
Model no.: US1D200P10 (DC input)  
Operating current selection switch setting: A
- For motors other than above...  
A driver is to be provided by the customer.

Note: The characteristics shown above are calculated using our experimental circuit.



# 28 mm sq.

1.8°/step **RoHS**

Bipolar, lead type

Unipolar, lead type ▶ p. 37



Custom options

Hollow shaft Custom shaft

Gear Encoder

Note: Customization feasibility depends on the model number and quantity. Contact us for details.

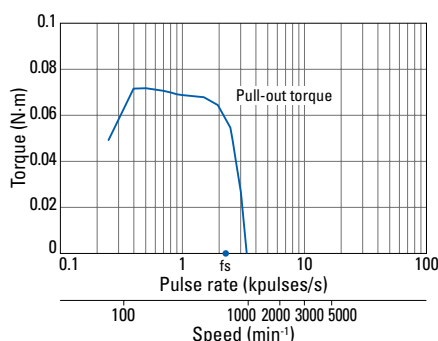
## Bipolar, lead type

| Model no.    |             | Holding torque at 2-phase excitation | Rated current | Winding resistance | Winding inductance | Rotor inertia                               | Mass | Motor length (L) |
|--------------|-------------|--------------------------------------|---------------|--------------------|--------------------|---------------------------------------------|------|------------------|
| Single shaft | Dual shaft  | N·m or more                          | A/phase       | Ω/phase            | mH/phase           | $\times 10^{-4} \text{kg} \cdot \text{m}^2$ | kg   | mm               |
| SH2281-5671  | SH2281-5631 | 0.07                                 | 0.5           | 10.5               | 7.2                | 0.01                                        | 0.11 | 32               |
| SH2281-5771  | SH2281-5731 | 0.07                                 | 1             | 2.6                | 1.85               | 0.01                                        | 0.11 | 32               |
| SH2285-5671  | SH2285-5631 | 0.145                                | 0.5           | 15                 | 13.5               | 0.022                                       | 0.2  | 51.5             |
| SH2285-5771  | SH2285-5731 | 0.145                                | 1             | 3.75               | 3.4                | 0.022                                       | 0.2  | 51.5             |

## Characteristics

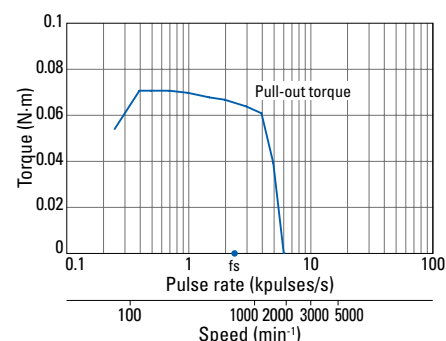
### SH2281-5671 SH2281-5631

Constant current circuit  
Input voltage: 24 VDC  
Winding current:  
0.5 A/phase  
At 2-phase excitation (full step)  
Pull-out torque:  
 $J_L = 0.01 \times 10^{-4} \text{kg} \cdot \text{m}^2$   
(Pulley balancer method)  
fs: Maximum starting pulse rate with no load



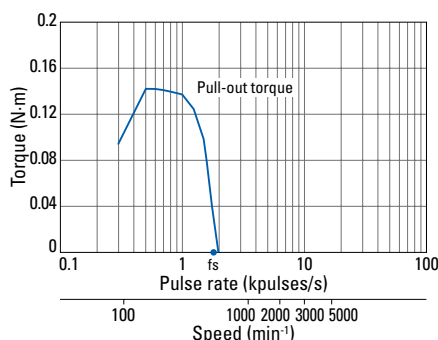
### SH2281-5771 SH2281-5731

Constant current circuit  
Input voltage: 24 VDC  
Winding current:  
1 A/phase  
At 2-phase excitation (full step)  
Pull-out torque:  
 $J_L = 0.01 \times 10^{-4} \text{kg} \cdot \text{m}^2$   
(Pulley balancer method)  
fs: Maximum starting pulse rate with no load



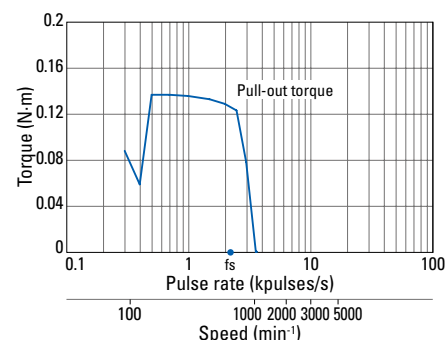
### SH2285-5671 SH2285-5631

Constant current circuit  
Input voltage: 24 VDC  
Winding current:  
0.5 A/phase  
At 2-phase excitation (full step)  
Pull-out torque:  
 $J_L = 0.01 \times 10^{-4} \text{kg} \cdot \text{m}^2$   
(Pulley balancer method)  
fs: Maximum starting pulse rate with no load

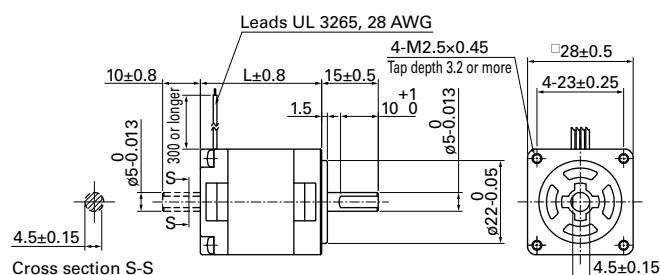


### SH2285-5771 SH2285-5731

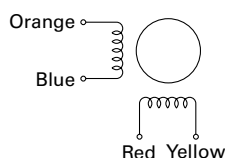
Constant current circuit  
Input voltage: 24 VDC  
Winding current:  
1 A/phase  
At 2-phase excitation (full step)  
Pull-out torque:  
 $J_L = 0.01 \times 10^{-4} \text{kg} \cdot \text{m}^2$   
(Pulley balancer method)  
fs: Maximum starting pulse rate with no load



## Dimensions (Unit: mm)



## Internal winding



## Compatible drivers

- For motors SH228 □ -57 □ 1 (1 A/phase)...  
Model no.: BS1D200P10 (DC input)  
Operating current selection switch setting: A
- For motors other than above...  
A driver is to be provided by the customer.

Note: The characteristics shown above are calculated using our experimental circuit.



# 35 mm sq.

1.8°/step **RoHS**

Unipolar, lead type

## Custom options

Hollow shaft Custom shaft

Note: Customization feasibility depends on the model number and quantity. Contact us for details.

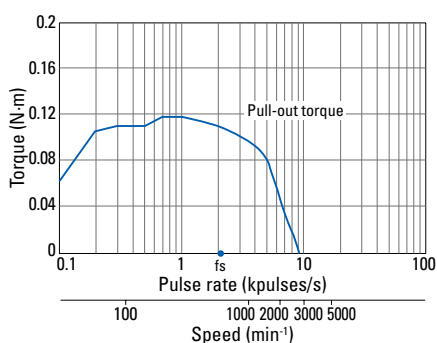
## Unipolar, lead type

| Model no.    |              | Holding torque<br>at 2-phase excitation | Rated<br>current | Winding<br>resistance | Winding inductance | Rotor<br>inertia                    | Mass | Motor<br>length (L) |
|--------------|--------------|-----------------------------------------|------------------|-----------------------|--------------------|-------------------------------------|------|---------------------|
| Single shaft | Dual shaft   | N·m or more                             | A/phase          | Ω/phase               | mH/phase           | ×10 <sup>-4</sup> kg·m <sup>2</sup> | kg   | mm                  |
| SH3533-12U40 | SH3533-12U10 | 0.12                                    | 1.2              | 2.4                   | 1.3                | 0.02                                | 0.17 | 33                  |
| SH3537-12U40 | SH3537-12U10 | 0.15                                    | 1.2              | 2.7                   | 2                  | 0.025                               | 0.2  | 37                  |
| SH3552-12U40 | SH3552-12U10 | 0.23                                    | 1.2              | 3.4                   | 2.8                | 0.043                               | 0.3  | 52                  |

## Characteristics

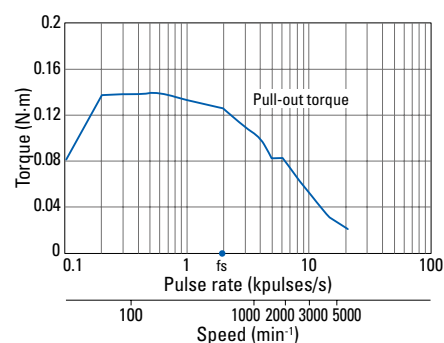
### SH3533-12U40 SH3533-12U10

Constant current circuit  
Input voltage: 24 VDC  
Winding current:  
1.2 A/phase  
At 2-phase excitation (full  
step)  
Pull-out torque:  
 $J_L = 0.33 \times 10^{-4} \text{kg} \cdot \text{m}^2$   
(with rubber coupling used)  
 $f_s$ : Maximum starting pulse  
rate with no load



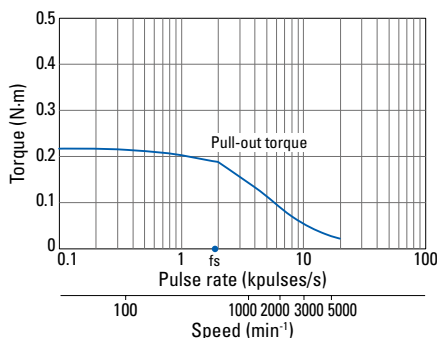
### SH3537-12U40 SH3537-12U10

Constant current circuit  
Input voltage: 24 VDC  
Winding current:  
1.2 A/phase  
At 2-phase excitation (full  
step)  
Pull-out torque:  
 $J_L = 0.33 \times 10^{-4} \text{kg} \cdot \text{m}^2$   
(with rubber coupling used)  
 $f_s$ : Maximum starting pulse  
rate with no load

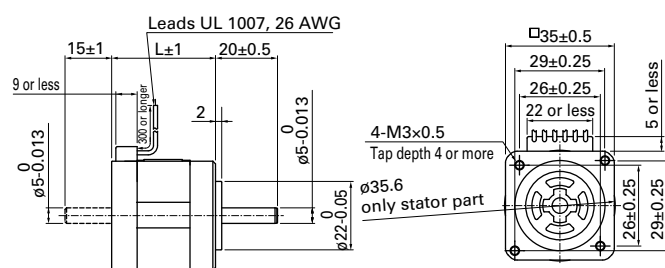


### SH3552-12U40 SH3552-12U10

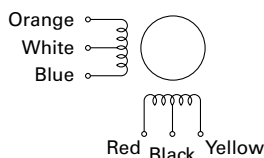
Constant current circuit  
Input voltage: 24 VDC  
Winding current:  
1.2 A/phase  
At 2-phase excitation (full  
step)  
Pull-out torque:  
 $J_L = 0.94 \times 10^{-4} \text{kg} \cdot \text{m}^2$   
(with rubber coupling used)  
 $f_s$ : Maximum starting pulse  
rate with no load



## Dimensions (Unit: mm)



## Internal winding



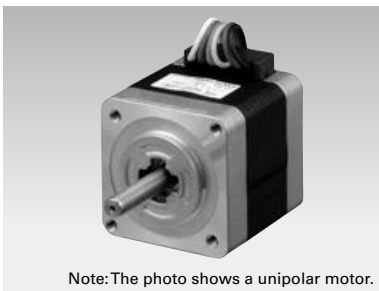
## Compatible drivers

Model no.: US1D200P10 (DC input)

Operating current selection switch setting: 8

Note: The characteristics shown above are calculated using our experimental circuit.

## Stepping Motors



# 35 mm sq.

1.8°/step **RoHS**

Bipolar, lead type

## Custom options

Hollow shaft Custom shaft

**Note:** Customization feasibility depends on the model number and quantity. Contact us for details.

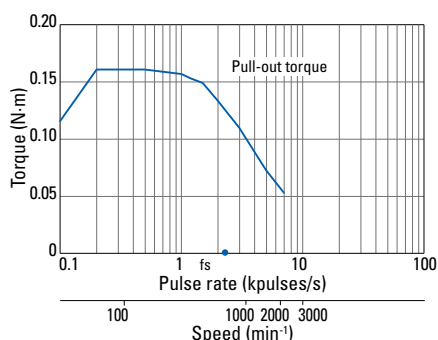
**Bipolar, lead type**

| Model no.    |              | Holding torque<br>at 2-phase excitation | Rated<br>current | Winding<br>resistance | Winding inductance | Rotor<br>inertia                    | Mass | Motor<br>length (L) |
|--------------|--------------|-----------------------------------------|------------------|-----------------------|--------------------|-------------------------------------|------|---------------------|
| Single shaft | Dual shaft   | N·m or more                             | A/phase          | Ω/phase               | mH/phase           | ×10 <sup>-4</sup> kg·m <sup>2</sup> | kg   | mm                  |
| SH3533-10B40 | SH3533-10B10 | 0.155                                   | 1                | 3.3                   | 3.9                | 0.02                                | 0.17 | 33                  |
| SH3537-10B40 | SH3537-10B10 | 0.195                                   | 1                | 3.9                   | 5.5                | 0.025                               | 0.2  | 37                  |
| SH3552-10B40 | SH3552-10B10 | 0.32                                    | 1                | 4.45                  | 7                  | 0.043                               | 0.3  | 52                  |

## Characteristics

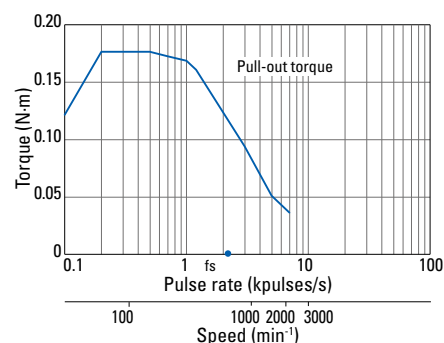
**SH3533-10B40**  
**SH3533-10B10**

Constant current circuit  
Input voltage: 24 VDC  
Winding current:  
1 A/phase  
At 2-phase excitation (full  
step)  
Pull-out torque:  
 $J_L = 0.33 \times 10^{-4} \text{ kg} \cdot \text{m}^2$   
(with rubber coupling used)  
 $f_s$ : Maximum starting pulse  
rate with no load



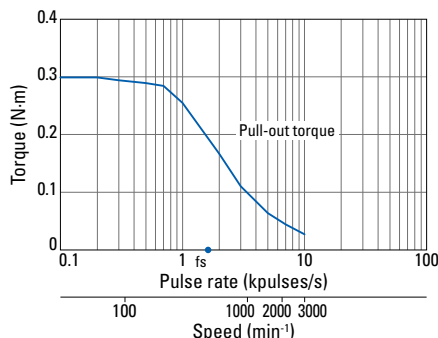
SH3537-10B40  
SH3537-10B10

Constant current circuit  
Input voltage: 24 VDC  
Winding current:  
1 A/phase  
At 2-phase excitation (full  
step)  
Pull-out torque:  
 $J_L = 0.33 \times 10^{-4} \text{ kg} \cdot \text{m}^2$   
(with rubber coupling used)  
 $f_s$ : Maximum starting pulse  
rate with no load

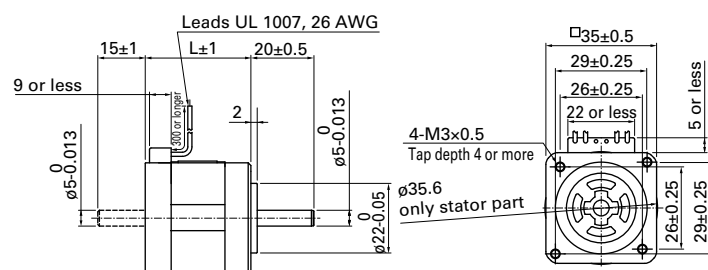


**SH3552-10B40**  
**SH3552-10B10**

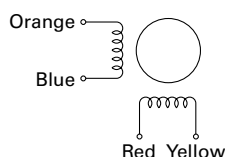
Constant current circuit  
Input voltage: 24 VDC  
Winding current:  
1 A/phase  
At 2-phase excitation (full  
step)  
Pull-out torque:  
 $J_c = 0.94 \times 10^{-6} \text{ kg} \cdot \text{m}^2$   
(with rubber coupling used)  
 $f_s$ : Maximum starting pulse  
rate with no load



## ■ Dimensions (Unit: mm)



## Internal winding



## Compatible drivers

Model no.: BS1D200P10 (DC input)

Operating current selection switch setting: A

Note: The characteristics shown above are calculated using our experimental circuit.



# 42 mm sq.

0.9°/step **RoHS**

Unipolar, lead type



Custom options

Hollow shaft Custom shaft

Gear Encoder

Note: Customization feasibility depends on the model number and quantity. Contact us for details.

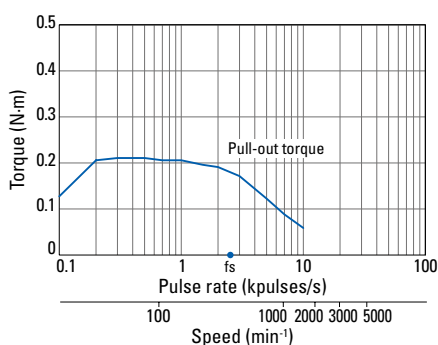
## Unipolar, lead type

| Model no.    |             | Holding torque<br>at 2-phase excitation | Rated<br>current | Winding<br>resistance | Winding inductance | Rotor<br>inertia                    | Mass | Motor<br>length (L) |
|--------------|-------------|-----------------------------------------|------------------|-----------------------|--------------------|-------------------------------------|------|---------------------|
| Single shaft | Dual shaft  | N·m or more                             | A/phase          | Ω/phase               | mH/phase           | ×10 <sup>-4</sup> kg·m <sup>2</sup> | kg   | mm                  |
| SH1421-0441  | SH1421-0411 | 0.2                                     | 1.2              | 2.7                   | 3.2                | 0.044                               | 0.24 | 33                  |
| SH1422-0441  | SH1422-0411 | 0.29                                    | 1.2              | 3.1                   | 5.3                | 0.066                               | 0.29 | 39                  |
| SH1424-0441  | SH1424-0411 | 0.39                                    | 1.2              | 3.5                   | 5.3                | 0.089                               | 0.38 | 48                  |

## Characteristics

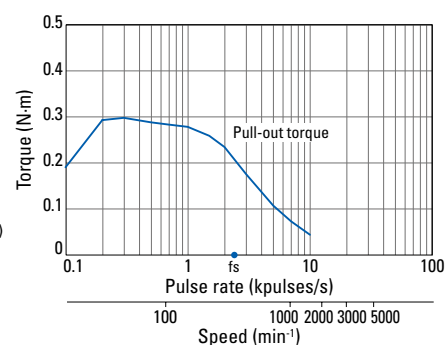
### SH1421-0441 SH1421-0411

Constant current circuit  
Input voltage: 24 VDC  
Winding current:  
1.2 A/phase  
At 2-phase excitation (full  
step)  
Pull-out torque:  
 $J_L = 0.94 \times 10^{-4} \text{kg} \cdot \text{m}^2$   
(with rubber coupling used)  
 $f_s$ : Maximum starting pulse  
rate with no load



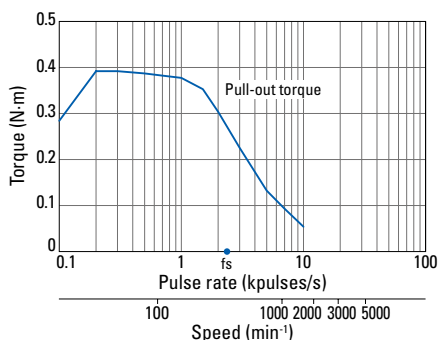
### SH1422-0441 SH1422-0411

Constant current circuit  
Input voltage: 24 VDC  
Winding current:  
1.2 A/phase  
At 2-phase excitation (full  
step)  
Pull-out torque:  
 $J_L = 0.94 \times 10^{-4} \text{kg} \cdot \text{m}^2$   
(with rubber coupling used)  
 $f_s$ : Maximum starting pulse  
rate with no load

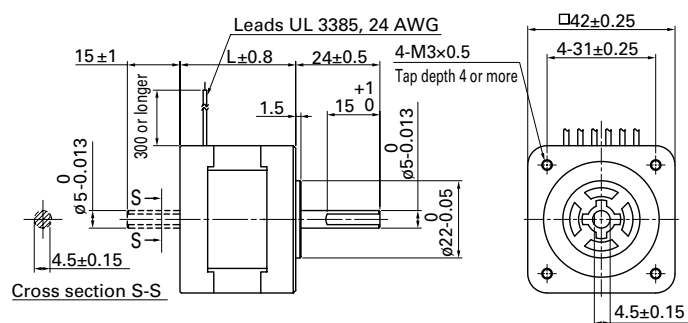


### SH1424-0441 SH1424-0411

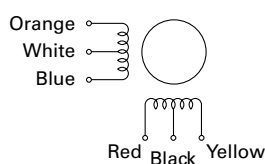
Constant current circuit  
Input voltage: 24 VDC  
Winding current:  
1.2 A/phase  
At 2-phase excitation (full  
step)  
Pull-out torque:  
 $J_L = 0.94 \times 10^{-4} \text{kg} \cdot \text{m}^2$   
(with rubber coupling used)  
 $f_s$ : Maximum starting pulse  
rate with no load



## Dimensions (Unit: mm)



## Internal winding



## Compatible drivers

Model no.: US1D200P10 (DC input)

Operating current selection switch setting: 8

Note: The characteristics shown above are calculated using our experimental circuit.





Note: The photo shows a unipolar motor.

# 42 mm sq.

0.9°/step **RoHS**

Bipolar, lead type



Custom options

Hollow shaft Custom shaft

Gear Encoder

Note: Customization feasibility depends on the model number and quantity. Contact us for details.

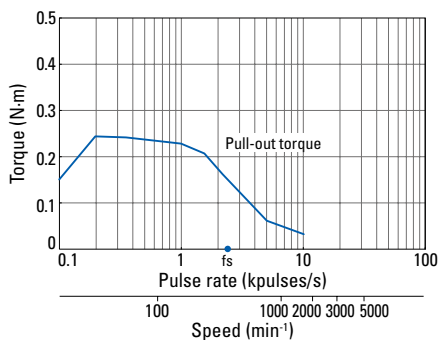
## Bipolar, lead type

| Model no.    |             | Holding torque at 2-phase excitation | Rated current | Winding resistance | Winding inductance | Rotor inertia                       | Mass | Motor length (L) |
|--------------|-------------|--------------------------------------|---------------|--------------------|--------------------|-------------------------------------|------|------------------|
| Single shaft | Dual shaft  | N·m or more                          | A/phase       | Ω/phase            | mH/phase           | ×10 <sup>-4</sup> kg·m <sup>2</sup> | kg   | mm               |
| SH1421-5041  | SH1421-5011 | 0.23                                 | 1             | 3.3                | 8.0                | 0.044                               | 0.24 | 33               |
| SH1421-5241  | SH1421-5211 | 0.23                                 | 2             | 0.85               | 2.1                | 0.044                               | 0.24 | 33               |
| SH1422-5041  | SH1422-5011 | 0.34                                 | 1             | 4.0                | 14.0               | 0.066                               | 0.29 | 39               |
| SH1422-5241  | SH1422-5211 | 0.34                                 | 2             | 1.05               | 3.6                | 0.066                               | 0.29 | 39               |
| SH1424-5041  | SH1424-5011 | 0.48                                 | 1             | 4.7                | 15.0               | 0.089                               | 0.38 | 48               |
| SH1424-5241  | SH1424-5211 | 0.48                                 | 2             | 1.25               | 3.75               | 0.089                               | 0.38 | 48               |

## Characteristics

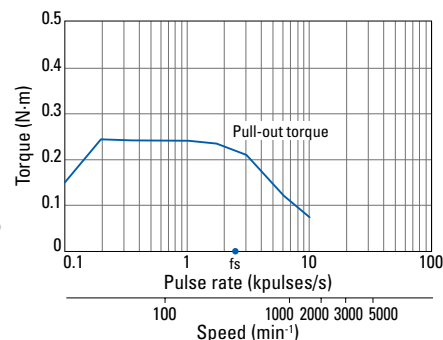
### SH1421-5041 SH1421-5011

Constant current circuit  
Input voltage: 24 VDC  
Winding current:  
1 A/phase  
At 2-phase excitation (full step)  
Pull-out torque:  
 $J_L = 0.94 \times 10^{-4} \text{kg} \cdot \text{m}^2$   
(with rubber coupling used)  
fs: Maximum starting pulse rate with no load



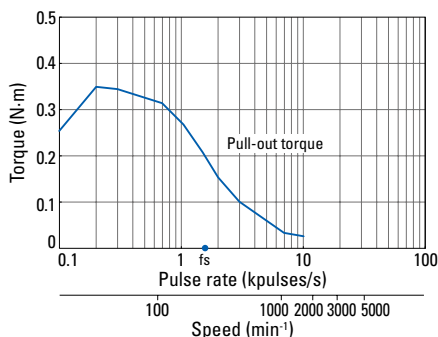
### SH1421-5241 SH1421-5211

Constant current circuit  
Input voltage: 24 VDC  
Winding current:  
2 A/phase  
At 2-phase excitation (full step)  
Pull-out torque:  
 $J_L = 0.94 \times 10^{-4} \text{kg} \cdot \text{m}^2$   
(with rubber coupling used)  
fs: Maximum starting pulse rate with no load



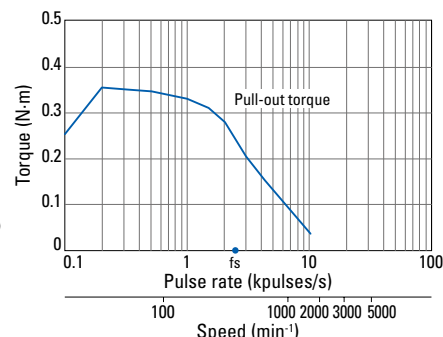
### SH1422-5041 SH1422-5011

Constant current circuit  
Input voltage: 24 VDC  
Winding current:  
1 A/phase  
At 2-phase excitation (full step)  
Pull-out torque:  
 $J_L = 0.94 \times 10^{-4} \text{kg} \cdot \text{m}^2$   
(with rubber coupling used)  
fs: Maximum starting pulse rate with no load



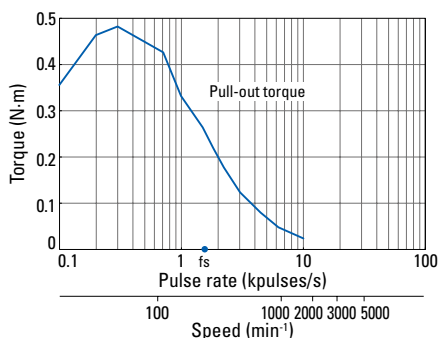
### SH1422-5241 SH1422-5211

Constant current circuit  
Input voltage: 24 VDC  
Winding current:  
2 A/phase  
At 2-phase excitation (full step)  
Pull-out torque:  
 $J_L = 0.94 \times 10^{-4} \text{kg} \cdot \text{m}^2$   
(with rubber coupling used)  
fs: Maximum starting pulse rate with no load



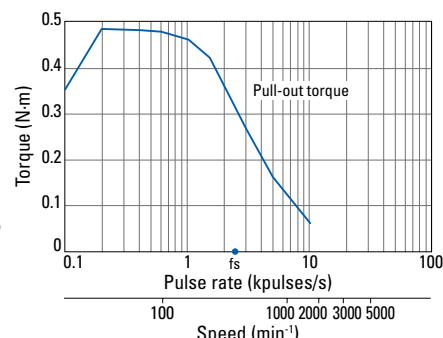
### SH1424-5041 SH1424-5011

Constant current circuit  
Input voltage: 24 VDC  
Winding current:  
1 A/phase  
At 2-phase excitation (full step)  
Pull-out torque:  
 $J_L = 0.94 \times 10^{-4} \text{kg} \cdot \text{m}^2$   
(with rubber coupling used)  
fs: Maximum starting pulse rate with no load

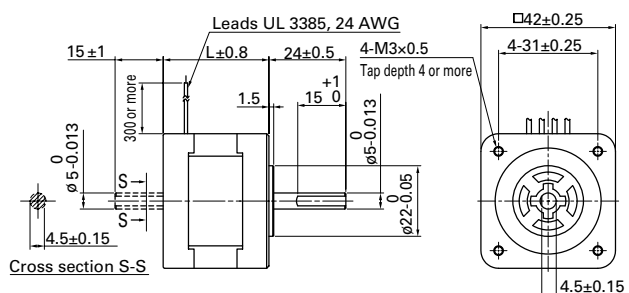


### SH1424-5241 SH1424-5211

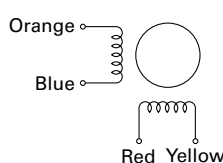
Constant current circuit  
Input voltage: 24 VDC  
Winding current:  
2 A/phase  
At 2-phase excitation (full step)  
Pull-out torque:  
 $J_L = 0.94 \times 10^{-4} \text{kg} \cdot \text{m}^2$   
(with rubber coupling used)  
fs: Maximum starting pulse rate with no load



## Dimensions (Unit: mm)



## Internal winding



## Compatible drivers

- For motors SH142 □ -52 □ 1 (2 A/phase)...  
Model no.: BS1D200P10 (DC input)  
Operating current selection switch setting: 0
- For motors SH142 □ -50 □ 1 (1 A/phase)...  
Model no.: BS1D200P10 (DC input)  
Operating current selection switch setting: A

Note: The characteristics shown above are calculated using our experimental circuit.

Allowable loads... ▶ p. 69 Internal wiring and rotational directions... ▶ p. 70

General specifications... ▶ p. 71

Data is measured under the drive conditions of SANYO DENKI. Drive torque may vary depending on the actual machine precision.



**42 mm sq.**

1.8°/step

### Thin-profile

RoHS

Bipolar, lead type



### Custom options

Hollow shaft

Custom shaft

Encoder

**Note:** Customization feasibility depends on the model number and quantity. Contact us for details.

**Bipolar, lead type** Radial load: 10 N

| Model no.          |                    | Holding torque<br>at 2-phase excitation | Rated<br>current | Winding<br>resistance | Winding inductance | Rotor<br>inertia                    | Mass | Motor<br>length (L) |
|--------------------|--------------------|-----------------------------------------|------------------|-----------------------|--------------------|-------------------------------------|------|---------------------|
| Single shaft       | Dual shaft         | N·m or more                             | A/phase          | Ω/phase               | mH/phase           | ×10 <sup>-4</sup> kg·m <sup>2</sup> | kg   | mm                  |
| <b>SS2421-5041</b> | <b>SS2421-5011</b> | 0.083                                   | 1                | 3.5                   | 1.2                | 0.015                               | 0.07 | 11.6                |
| <b>SS2422-5041</b> | <b>SS2422-5011</b> | 0.186                                   | 1                | 5.4                   | 2.9                | 0.028                               | 0.14 | 18.6                |

**Bipolar, lead type** Heavy duty Radial load: 25 N

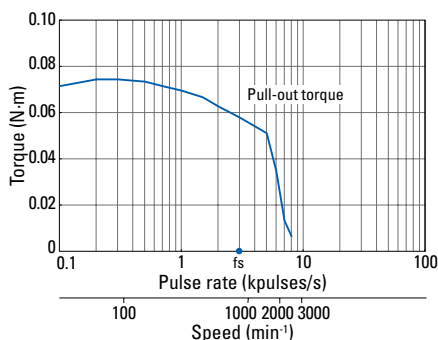
| Model no.           |                     | Holding torque<br>at 2-phase excitation | Rated<br>current | Winding<br>resistance | Winding inductance | Rotor<br>inertia                    | Mass | Motor<br>length (L) |
|---------------------|---------------------|-----------------------------------------|------------------|-----------------------|--------------------|-------------------------------------|------|---------------------|
| Single shaft        | Dual shaft          | N·m or more                             | A/phase          | Ω/phase               | mH/phase           | ×10 <sup>-4</sup> kg·m <sup>2</sup> | kg   | mm                  |
| <b>SS2421-50400</b> | <b>SS2421-50100</b> | 0.083                                   | 1                | 3.5                   | 1.2                | 0.015                               | 0.09 | 14.5                |
| <b>SS2422-50400</b> | <b>SS2422-50100</b> | 0.186                                   | 1                | 5.4                   | 2.9                | 0.028                               | 0.16 | 21.5                |

## Characteristics

SS2421-5041  
SS2421-5011

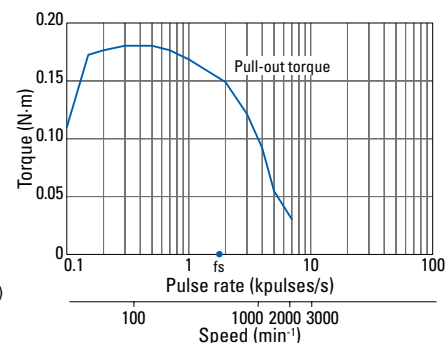
SS2421-50400  
SS2421-50100

Constant current circuit  
Input voltage: 24 VDC  
Winding current:  
1 A/phase  
At 2-phase excitation (full  
step)  
Pull-out torque:  
 $J_L = 0.33 \times 10^{-4} \text{ kg} \cdot \text{m}^2$   
(with rubber coupling used)  
fs: Maximum starting pulse  
rate with no load

SS2422-5041  
SS2422-5011

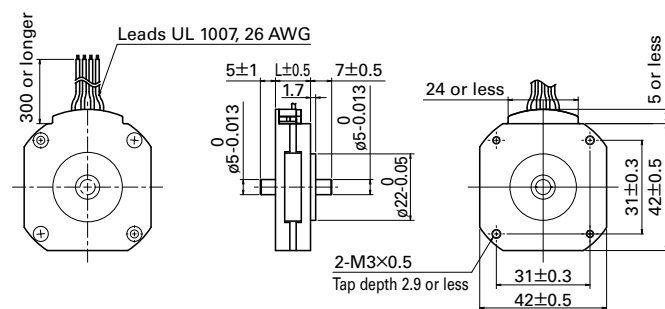
SS2422-50400  
SS2422-50100

Constant current circuit  
Input voltage: 24 VDC  
Winding current:  
1 A/phase  
At 2-phase excitation (full  
step)  
Pull-out torque:  
 $J_L = 0.33 \times 10^{-6} \text{ kg} \cdot \text{m}^2$   
(with rubber coupling used)  
fs: Maximum starting pulse  
rate with no load

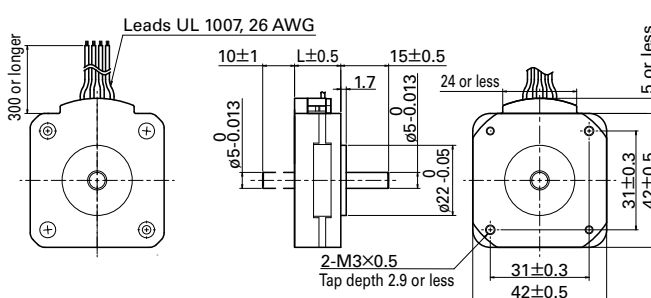


### Dimensions (Unit: mm)

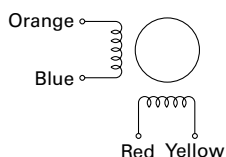
Model no.: SS242□-50□□



Model no.: SS242□-50□00



## Internal winding



## Compatible drivers

Model no.: BS1D200P10 (DC input)

Operating current selection switch setting: A

Note: The characteristics shown above are calculated using our experimental circuit.

# Stepping Motors



**42 mm sq.**

1.8°/step

RoHS

Unipolar, connector type

Bipolar, connector type ► p. 45



### Custom options

Custom shaft

## Gear

Encoder

Brake

**Note:** Customization feasibility depends on the model number and quantity. Contact us for details.

**Unipolar, connector type**

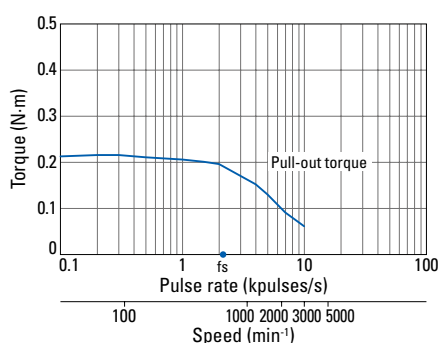
| Model no.           |                     | Holding torque<br>at 2-phase excitation | Rated<br>current | Winding<br>resistance | Winding inductance | Rotor<br>inertia                     | Mass | Motor<br>length (L) |
|---------------------|---------------------|-----------------------------------------|------------------|-----------------------|--------------------|--------------------------------------|------|---------------------|
| Single shaft        | Dual shaft          | N·m or more                             | A/phase          | Ω/phase               | mH/phase           | ×10 <sup>-4</sup> ·kg·m <sup>2</sup> | kg   | mm                  |
| <b>SF2421-12U41</b> | <b>SF2421-12U11</b> | 0.22                                    | 1.2              | 2.4                   | 2.4                | 0.031                                | 0.23 | 33 ± 0.5            |
| <b>SF2422-12U41</b> | <b>SF2422-12U11</b> | 0.33                                    | 1.2              | 3                     | 3.3                | 0.046                                | 0.3  | 39 ± 0.5            |
| <b>SF2423-12U41</b> | <b>SF2423-12U11</b> | 0.4                                     | 1.2              | 3.4                   | 3.9                | 0.063                                | 0.38 | 48 ± 0.5            |
| <b>SF2424-12U41</b> | <b>SF2424-12U11</b> | 0.58                                    | 1.2              | 4.4                   | 5.4                | 0.094                                | 0.51 | 59.5 ± 1            |

Motor cable model no.: 4835774-1

## Characteristics

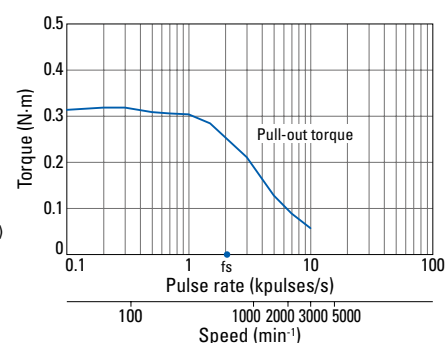
SF2421-12U41  
SF2421-12U11

Constant current circuit  
Input voltage: 24 VDC  
Winding current:  
1.2 A/phase  
At 2-phase excitation (full  
step)  
Pull-out torque:  
 $J_L = 0.94 \times 10^{-4} \text{ kg} \cdot \text{m}^2$   
(with rubber coupling used)  
 $f_s$ : Maximum starting pulse  
rate with no load



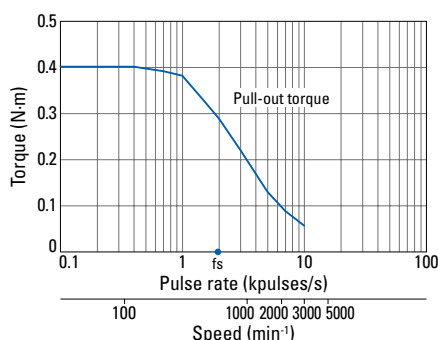
SF2422-12U41  
SF2422-12U11

Constant current circuit  
Input voltage: 24 VDC  
Winding current:  
1.2 A/phase  
At 2-phase excitation (full  
step)  
Pull-out torque:  
 $J_L = 0.94 \times 10^{-6} \text{ kg} \cdot \text{m}^2$   
(with rubber coupling used)  
fs: Maximum starting pulse  
rate with no load



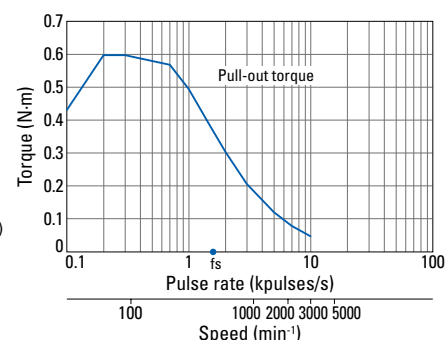
SF2423-12U41  
SF2423-12U11

Constant current circuit  
Input voltage: 24 VDC  
Winding current:  
1.2 A/phase  
At 2-phase excitation (full  
step)  
Pull-out torque:  
 $J_L = 0.94 \times 10^{-4} \text{ kg} \cdot \text{m}^2$   
(with rubber coupling used)  
fs: Maximum starting pulse  
rate with no load

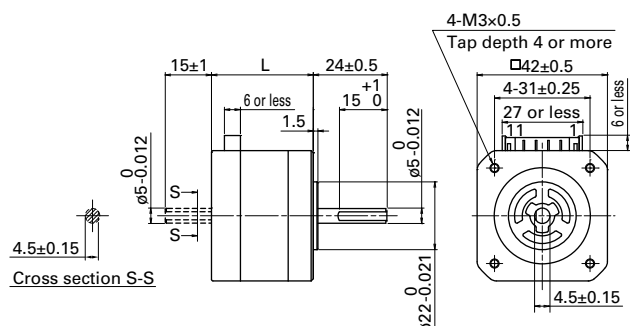


SF2424-12U41  
SF2424-12U11

Constant current circuit  
Input voltage: 24 VDC  
Winding current:  
1.2 A/phase  
At 2-phase excitation (full  
step)  
Pull-out torque:  
 $J_L = 0.94 \times 10^{-3} \text{ kg} \cdot \text{m}^2$   
(with rubber coupling used)  
fs: Maximum starting pulse  
rate with no load



### Dimensions (Unit: mm)



Separate option: Motor cable 4835774-1

Mfr.: J.S.T.

Housing: PHR-11

Terminal: SPH-002T-P0.5S

Diagram illustrating the terminal colors and lead configuration for a 10-conductor cable. The terminals are labeled 1 through 11, with corresponding lead colors: Orange, White, Blue, Yellow, Black, and Red. The leads are labeled "Leads UL 1007, 26 AWG".

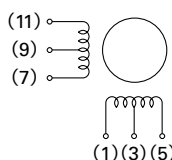
| Terminal no. | Lead color |
|--------------|------------|
| 11           | Orange     |
| 9            | White      |
| 7            | Blue       |
| 5            | Yellow     |
| 3            | Black      |
| 1            | Red        |

Leads UL 1007, 26 AWG

This is a motor cable for model nos. SF242□-12U□1

## Internal wiring

In parentheses are connector pin nos.



## Compatible drivers

Model no.: US1D200P10 (DC input)

Operating current selection switch setting: 8

Note: The characteristics shown above are calculated using our experimental circuit.

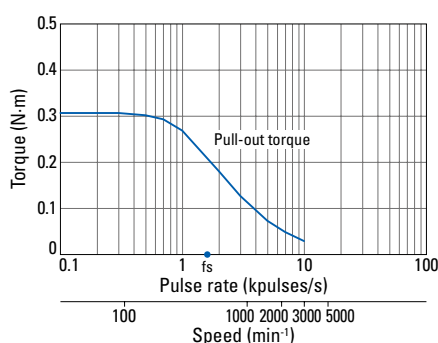
**Bipolar, connector type**

| Model no.    |              | Holding torque<br>at 2-phase excitation | Rated<br>current | Winding<br>resistance | Winding inductance | Rotor<br>inertia                            | Mass | Motor<br>length (L) |
|--------------|--------------|-----------------------------------------|------------------|-----------------------|--------------------|---------------------------------------------|------|---------------------|
| Single shaft | Dual shaft   | N·m or more                             | A/phase          | Ω/phase               | mH/phase           | $\times 10^{-4} \text{kg} \cdot \text{m}^2$ | kg   | mm                  |
| SF2421-10B41 | SF2421-10B11 | 0.29                                    | 1                | 3.6                   | 7                  | 0.031                                       | 0.23 | $33 \pm 0.5$        |
| SF2422-10B41 | SF2422-10B11 | 0.43                                    | 1                | 4.6                   | 9.6                | 0.046                                       | 0.3  | $39 \pm 0.5$        |
| SF2423-10B41 | SF2423-10B11 | 0.56                                    | 1                | 5.3                   | 12.5               | 0.063                                       | 0.38 | $48 \pm 0.5$        |
| SF2424-10B41 | SF2424-10B11 | 0.8                                     | 1                | 6.5                   | 16                 | 0.094                                       | 0.51 | $59.5 \pm 1$        |

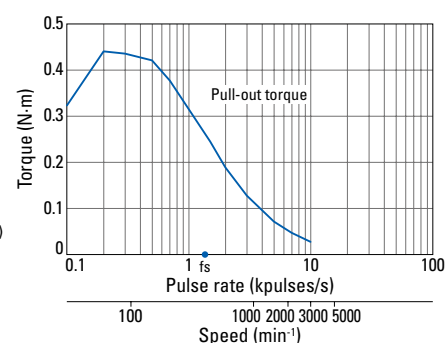
Motor cable model no.: 4835775-1

**Characteristics****SF2421-10B41  
SF2421-10B11**

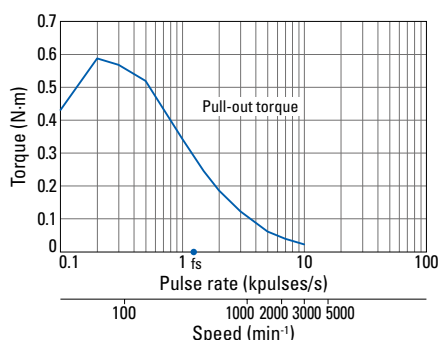
Constant current circuit  
Input voltage: 24 VDC  
Winding current:  
1 A/phase  
At 2-phase excitation (full  
step)  
Pull-out torque:  
 $J_L = 0.94 \times 10^{-4} \text{kg} \cdot \text{m}^2$   
(with rubber coupling used)  
 $f_s$ : Maximum starting pulse  
rate with no load

**SF2422-10B41  
SF2422-10B11**

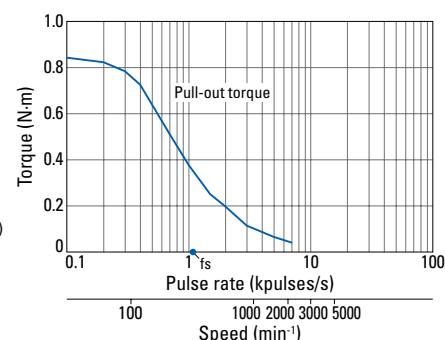
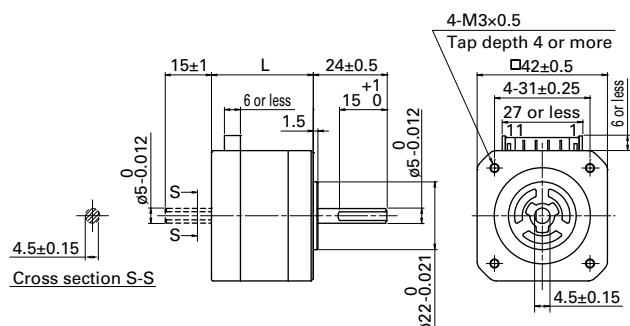
Constant current circuit  
Input voltage: 24 VDC  
Winding current:  
1 A/phase  
At 2-phase excitation (full  
step)  
Pull-out torque:  
 $J_L = 0.94 \times 10^{-4} \text{kg} \cdot \text{m}^2$   
(with rubber coupling used)  
 $f_s$ : Maximum starting pulse  
rate with no load

**SF2423-10B41  
SF2423-10B11**

Constant current circuit  
Input voltage: 24 VDC  
Winding current:  
1 A/phase  
At 2-phase excitation (full  
step)  
Pull-out torque:  
 $J_L = 0.94 \times 10^{-4} \text{kg} \cdot \text{m}^2$   
(with rubber coupling used)  
 $f_s$ : Maximum starting pulse  
rate with no load

**SF2424-10B41  
SF2424-10B11**

Constant current circuit  
Input voltage: 24 VDC  
Winding current:  
1 A/phase  
At 2-phase excitation (full  
step)  
Pull-out torque:  
 $J_L = 2.6 \times 10^{-4} \text{kg} \cdot \text{m}^2$   
(with rubber coupling used)  
 $f_s$ : Maximum starting pulse  
rate with no load

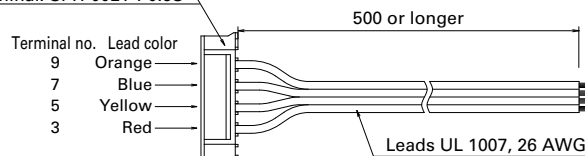
**Dimensions (Unit: mm)**

Separate option: Motor cable 4835775-1

Mfr.: J.S.T.

Housing: PHR-11

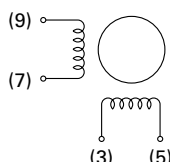
Terminal: SPH-002T-P0.5S



This is a motor cable for model nos. SF242□-10B□1

**Internal wiring**

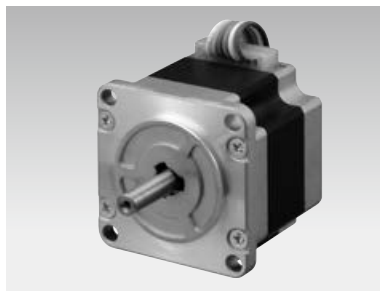
In parentheses are connector pin nos.

**Compatible drivers**

Model no.: BS1D200P10 (DC input)

Operating current selection switch setting: A

Note: The characteristics shown above are calculated using our experimental circuit.



# 50 mm sq.

1.8°/step **RoHS**

Unipolar, lead type  
Bipolar, lead type ▶ p. 48

## Custom options

Hollow shaft Custom shaft  
Encoder

Note: Customization feasibility depends on the model number and quantity. Contact us for details.

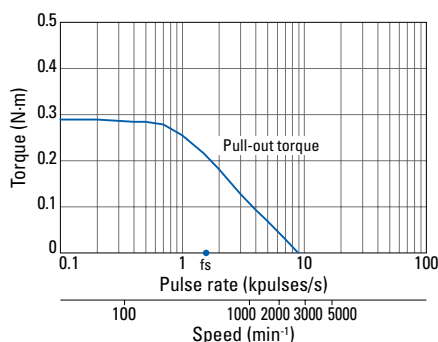
## Unipolar, lead type

| Model no.     |               | Holding torque at 2-phase excitation | Rated current | Winding resistance | Winding inductance | Rotor inertia                       | Mass | Motor length (L) |
|---------------|---------------|--------------------------------------|---------------|--------------------|--------------------|-------------------------------------|------|------------------|
| Single shaft  | Dual shaft    | N·m or more                          | A/phase       | Ω/phase            | mH/phase           | ×10 <sup>-4</sup> kg·m <sup>2</sup> | kg   | mm               |
| 103H6701-0140 | 103H6701-0110 | 0.28                                 | 1             | 4.3                | 6.8                | 0.057                               | 0.35 | 39.8             |
| 103H6701-0440 | 103H6701-0410 | 0.28                                 | 2             | 1.1                | 1.6                | 0.057                               | 0.35 | 39.8             |
| 103H6701-0740 | 103H6701-0710 | 0.28                                 | 3             | 0.6                | 0.7                | 0.057                               | 0.35 | 39.8             |
| 103H6703-0140 | 103H6703-0110 | 0.49                                 | 1             | 6                  | 13                 | 0.118                               | 0.5  | 51.3             |
| 103H6703-0440 | 103H6703-0410 | 0.49                                 | 2             | 1.6                | 3.2                | 0.118                               | 0.5  | 51.3             |
| 103H6703-0740 | 103H6703-0710 | 0.49                                 | 3             | 0.83               | 1.4                | 0.118                               | 0.5  | 51.3             |
| 103H6704-0140 | 103H6704-0110 | 0.52                                 | 1             | 6.5                | 16.5               | 0.14                                | 0.55 | 55.8             |
| 103H6704-0440 | 103H6704-0410 | 0.52                                 | 2             | 1.7                | 3.8                | 0.14                                | 0.55 | 55.8             |
| 103H6704-0740 | 103H6704-0710 | 0.53                                 | 3             | 0.9                | 1.7                | 0.14                                | 0.55 | 55.8             |

## Characteristics

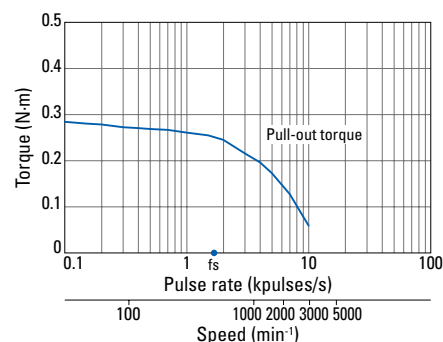
### 103H6701-0140 103H6701-0110

Constant current circuit  
Input voltage: 24 VDC  
Winding current:  
1 A/phase  
At 2-phase excitation (full step)  
Pull-out torque:  
 $J_L = 0.94 \times 10^{-4} \text{kg} \cdot \text{m}^2$   
(with rubber coupling used)  
fs: Maximum starting pulse rate with no load



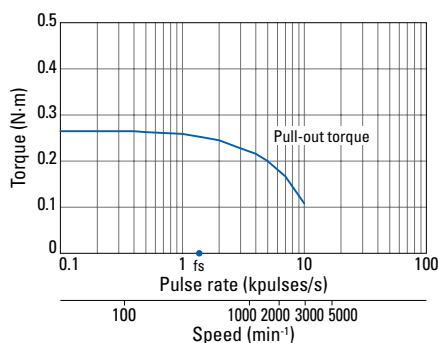
### 103H6701-0440 103H6701-0410

Constant current circuit  
Input voltage: 24 VDC  
Winding current:  
2 A/phase  
At 2-phase excitation (full step)  
Pull-out torque:  
 $J_L = 0.94 \times 10^{-4} \text{kg} \cdot \text{m}^2$   
(with rubber coupling used)  
fs: Maximum starting pulse rate with no load



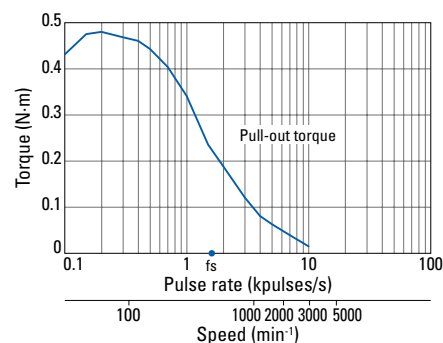
### 103H6701-0740 103H6701-0710

Constant current circuit  
Input voltage: 24 VDC  
Winding current:  
3 A/phase  
At 2-phase excitation (full step)  
Pull-out torque:  
 $J_L = 0.94 \times 10^{-4} \text{kg} \cdot \text{m}^2$   
(with rubber coupling used)  
fs: Maximum starting pulse rate with no load



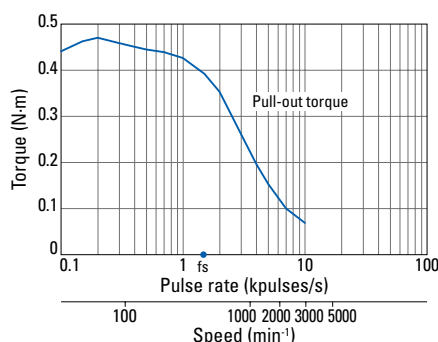
### 103H6703-0140 103H6703-0110

Constant current circuit  
Input voltage: 24 VDC  
Winding current:  
1 A/phase  
At 2-phase excitation (full step)  
Pull-out torque:  
 $J_L = 0.94 \times 10^{-4} \text{kg} \cdot \text{m}^2$   
(with rubber coupling used)  
fs: Maximum starting pulse rate with no load



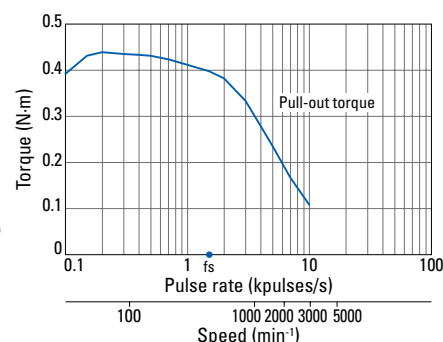
### 103H6703-0440 103H6703-0410

Constant current circuit  
Input voltage: 24 VDC  
Winding current:  
2 A/phase  
At 2-phase excitation (full step)  
Pull-out torque:  
 $J_L = 0.94 \times 10^{-4} \text{kg} \cdot \text{m}^2$   
(with rubber coupling used)  
fs: Maximum starting pulse rate with no load



### 103H6703-0740 103H6703-0710

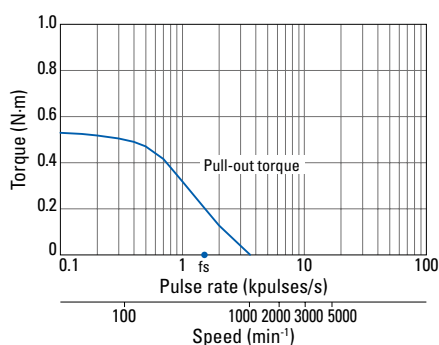
Constant current circuit  
Input voltage: 24 VDC  
Winding current:  
3 A/phase  
At 2-phase excitation (full step)  
Pull-out torque:  
 $J_L = 0.94 \times 10^{-4} \text{kg} \cdot \text{m}^2$   
(with rubber coupling used)  
fs: Maximum starting pulse rate with no load



## Characteristics

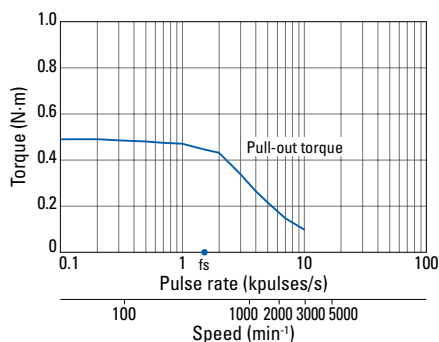
103H6704-0140  
103H6704-0110

Constant current circuit  
Input voltage: 24 VDC  
Winding current:  
1 A/phase  
At 2-phase excitation (full  
step)  
Pull-out torque:  
 $J_L = 0.94 \times 10^{-4} \text{ kg} \cdot \text{m}^2$   
(with rubber coupling used)  
 $f_s$ : Maximum starting pulse  
rate with no load



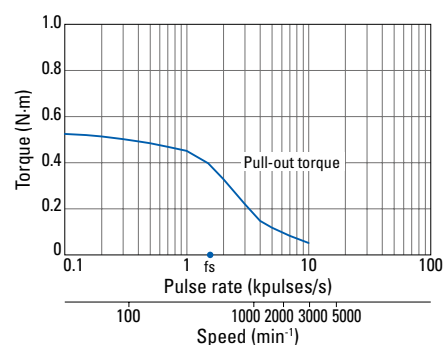
103H6704-0740  
103H6704-0710

Constant current circuit  
Input voltage: 24 VDC  
Winding current:  
3 A/phase  
At 2-phase excitation (full  
step)  
Pull-out torque:  
 $J_L = 0.94 \times 10^{-4} \text{ kg} \cdot \text{m}^2$   
(with rubber coupling used)  
 $f_s$ : Maximum starting pulse  
rate with no load

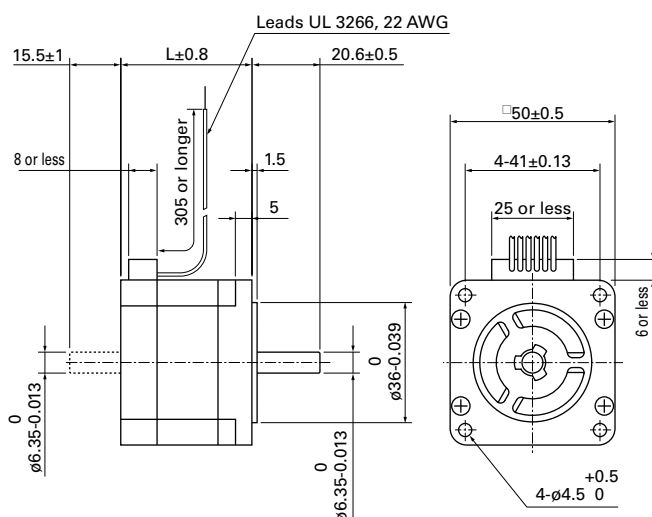


103H6704-0440  
103H6704-0410

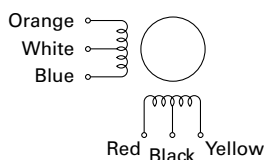
Constant current circuit  
Input voltage: 24 VDC  
Winding current:  
2 A/phase  
At 2-phase excitation (full  
step)  
Pull-out torque:  
 $J_L = 0.94 \times 10^{-6} \text{ kg} \cdot \text{m}^2$   
(with rubber coupling used)  
fs: Maximum starting pulse  
rate with no load



### ■ Dimensions (Unit: mm)



## Internal winding

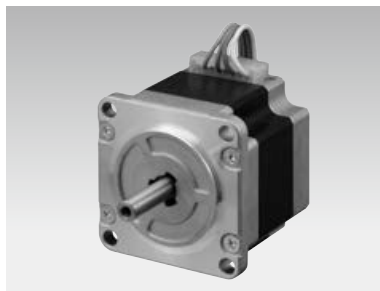


## Compatible drivers

- For motors 103H670 □ -04 □ 0 (2 A/phase) ...  
Model no.: US1D200P10 (DC input)  
Operating current selection switch setting: 0
- For motors other than above...

A driver is to be provided by the customer.

Note: The characteristics shown above are calculated using our experimental circuit.



# 50 mm sq.

1.8°/step **RoHS**

Bipolar, lead type

Unipolar, lead type ▶ p. 46

## Custom options

Hollow shaft Custom shaft

Encoder

Note: Customization feasibility depends on the model number and quantity. Contact us for details.

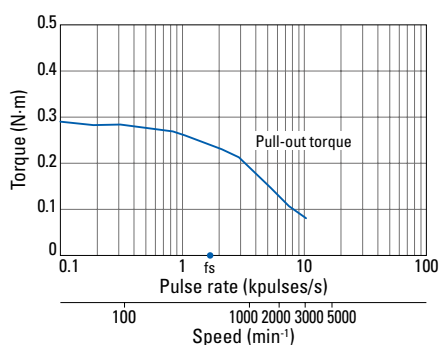
## Bipolar, lead type

| Model no.     |               | Holding torque at 2-phase excitation | Rated current | Winding resistance | Winding inductance | Rotor inertia                       | Mass | Motor length (L) |
|---------------|---------------|--------------------------------------|---------------|--------------------|--------------------|-------------------------------------|------|------------------|
| Single shaft  | Dual shaft    | N·m or more                          | A/phase       | Ω/phase            | mH/phase           | ×10 <sup>-4</sup> kg·m <sup>2</sup> | kg   | mm               |
| 103H6701-5040 | 103H6701-5010 | 0.28                                 | 2             | 0.6                | 1.6                | 0.057                               | 0.35 | 39.8             |
| 103H6703-5040 | 103H6703-5010 | 0.49                                 | 2             | 0.8                | 3.2                | 0.118                               | 0.5  | 51.3             |
| 103H6704-5040 | 103H6704-5010 | 0.52                                 | 2             | 0.9                | 3.8                | 0.14                                | 0.55 | 55.8             |

## Characteristics

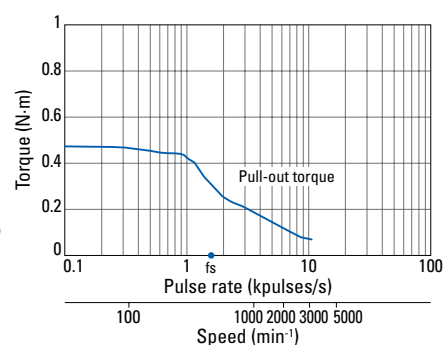
### 103H6701-5040 103H6701-5010

Constant current circuit  
Input voltage: 24 VDC  
Winding current:  
2 A/phase  
At 2-phase excitation (full step)  
Pull-out torque:  
 $J_L = 0.94 \times 10^{-4} \text{kg} \cdot \text{m}^2$   
(with rubber coupling used)  
 $f_s$ : Maximum starting pulse rate with no load



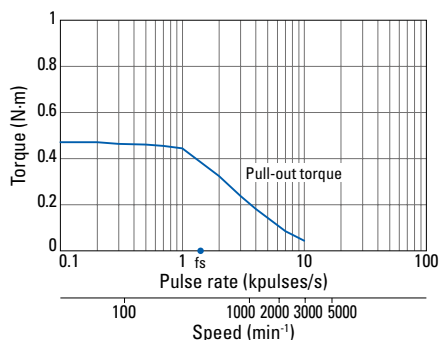
### 103H6703-5040 103H6703-5010

Constant current circuit  
Input voltage: 24 VDC  
Winding current:  
2 A/phase  
At 2-phase excitation (full step)  
Pull-out torque:  
 $J_L = 0.94 \times 10^{-4} \text{kg} \cdot \text{m}^2$   
(with rubber coupling used)  
 $f_s$ : Maximum starting pulse rate with no load

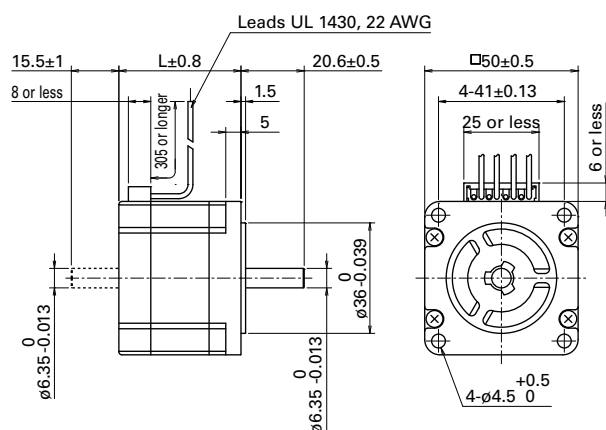


### 103H6704-5040 103H6704-5010

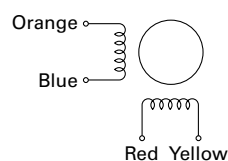
Constant current circuit  
Input voltage: 24 VDC  
Winding current:  
2 A/phase  
At 2-phase excitation (full step)  
Pull-out torque:  
 $J_L = 0.94 \times 10^{-4} \text{kg} \cdot \text{m}^2$   
(with rubber coupling used)  
 $f_s$ : Maximum starting pulse rate with no load



## Dimensions (Unit: mm)



## Internal winding



## Compatible drivers

Model no.: BS1D200P10 (DC input)

Operating current selection switch setting: 0

Note: The characteristics shown above are calculated using our experimental circuit.





# 50 mm sq.

1.8°/step

Thin-profile RoHS

Bipolar, lead type

Custom options

Hollow shaft Custom shaft

Note: Customization feasibility depends on the model number and quantity. Contact us for details.

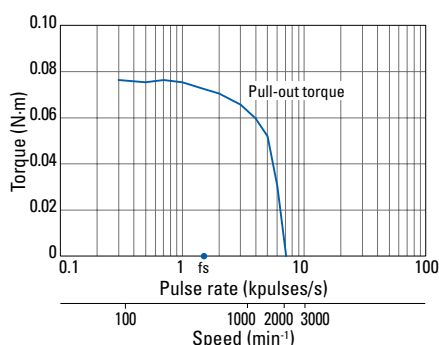
## Bipolar, lead type

| Model no.          |                    | Holding torque<br>at 2-phase excitation | Rated<br>current | Winding<br>resistance | Winding inductance | Rotor<br>inertia                   | Mass | Motor<br>length (L) |
|--------------------|--------------------|-----------------------------------------|------------------|-----------------------|--------------------|------------------------------------|------|---------------------|
| Single shaft       | Dual shaft         | N·m or more                             | A/phase          | Ω/phase               | mH/phase           | $\times 10^{-4}$ kg·m <sup>2</sup> | kg   | mm                  |
| <b>SS2501-8040</b> | <b>SS2501-8010</b> | 0.1                                     | 1                | 4.5                   | 2                  | 0.026                              | 0.09 | 11.4                |
| <b>SS2502-8040</b> | <b>SS2502-8010</b> | 0.215                                   | 1                | 5.9                   | 3.2                | 0.049                              | 0.15 | 16.4                |

## Characteristics

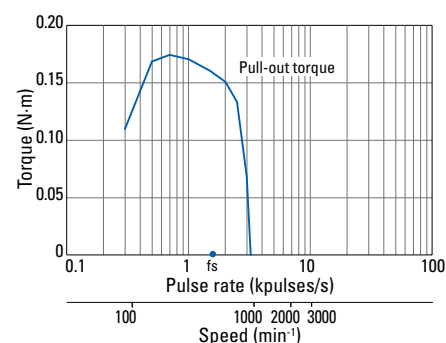
### SS2501-8040 SS2501-8010

Constant current circuit  
Input voltage: 24 VDC  
Winding current:  
1 A/phase  
At 2-phase excitation (full  
step)  
Pull-out torque:  
 $J_L = 0.01 \times 10^{-4}$  kg·m<sup>2</sup>  
(Pulley balancer method)  
fs: Maximum starting pulse  
rate with no load

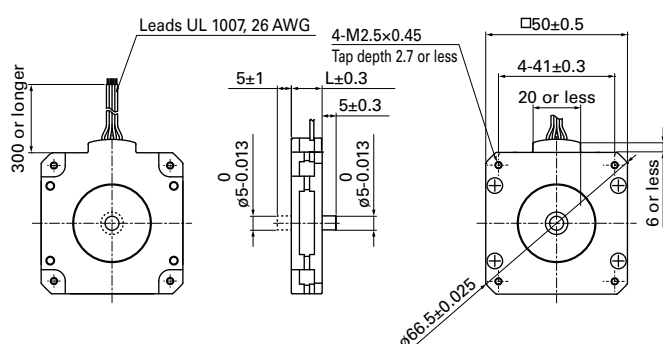


### SS2502-8040 SS2502-8010

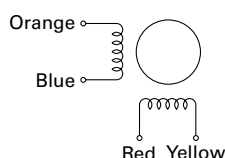
Constant current circuit  
Input voltage: 24 VDC  
Winding current:  
1 A/phase  
At 2-phase excitation (full  
step)  
Pull-out torque:  
 $J_L = 0.01 \times 10^{-4}$  kg·m<sup>2</sup>  
(Pulley balancer method)  
fs: Maximum starting pulse  
rate with no load



## Dimensions (Unit: mm)



## Internal winding



## Compatible drivers

Model no.: BS1D200P10 (DC input)

Operating current selection switch setting: A



# 56 mm sq.

1.8°/step **RoHS**

Unipolar, connector type



**Custom options**

Hollow shaft Custom shaft

Gear Encoder

Brake

Note: Customization feasibility depends on the model number and quantity. Contact us for details.

## Unipolar, connector type

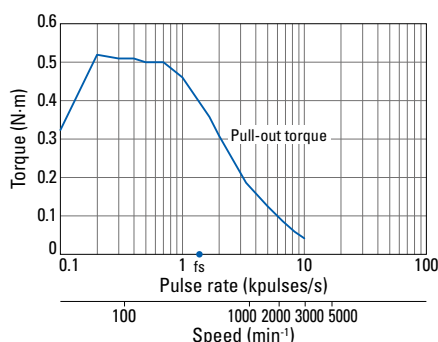
| Model no.           |                     | Holding torque at 2-phase excitation | Rated current | Winding resistance | Winding inductance | Rotor inertia                       | Mass | Motor length (L) |
|---------------------|---------------------|--------------------------------------|---------------|--------------------|--------------------|-------------------------------------|------|------------------|
| Single shaft        | Dual shaft          | N·m or more                          | A/phase       | Ω/phase            | mH/phase           | ×10 <sup>-4</sup> kg·m <sup>2</sup> | kg   | mm               |
| <b>SM2561C10U41</b> | <b>SM2561C10U11</b> | 0.53                                 | 1             | 4.3                | 6.8                | 0.14                                | 0.49 | 41.8             |
| <b>SM2561C20U41</b> | <b>SM2561C20U11</b> | 0.53                                 | 2             | 1.15               | 1.8                | 0.14                                | 0.49 | 41.8             |
| <b>SM2561C30U41</b> | <b>SM2561C30U11</b> | 0.53                                 | 3             | 0.52               | 0.77               | 0.14                                | 0.49 | 41.8             |
| <b>SM2562C10U41</b> | <b>SM2562C10U11</b> | 1.1                                  | 1             | 5.85               | 12.6               | 0.28                                | 0.69 | 53.8             |
| <b>SM2562C20U41</b> | <b>SM2562C20U11</b> | 1.1                                  | 2             | 1.55               | 3.3                | 0.28                                | 0.69 | 53.8             |
| <b>SM2562C30U41</b> | <b>SM2562C30U11</b> | 1.1                                  | 3             | 0.69               | 1.37               | 0.28                                | 0.69 | 53.8             |
| <b>SM2563C10U41</b> | <b>SM2563C10U11</b> | 1.7                                  | 1             | 7.8                | 17                 | 0.5                                 | 1.1  | 75.8             |
| <b>SM2563C20U41</b> | <b>SM2563C20U11</b> | 1.7                                  | 2             | 1.87               | 4.2                | 0.5                                 | 1.1  | 75.8             |
| <b>SM2563C30U41</b> | <b>SM2563C30U11</b> | 1.7                                  | 3             | 0.74               | 1.75               | 0.5                                 | 1.1  | 75.8             |
| <b>SM2564C10U41</b> | <b>SM2564C10U11</b> | 1.75                                 | 1             | 9                  | 22                 | 0.6                                 | 1.27 | 85.8             |
| <b>SM2564C20U41</b> | <b>SM2564C20U11</b> | 1.75                                 | 2             | 2.1                | 5.4                | 0.6                                 | 1.27 | 85.8             |
| <b>SM2564C30U41</b> | <b>SM2564C30U11</b> | 1.75                                 | 3             | 0.84               | 2.2                | 0.6                                 | 1.27 | 85.8             |

Motor cable model no.: 4837798-1

## Characteristics

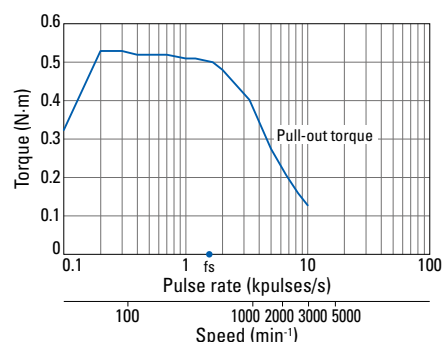
### SM2561C10U41 SM2561C10U11

Constant current circuit  
Input voltage: 24 VDC  
Winding current:  
1 A/phase  
At 2-phase excitation (full step)  
Pull-out torque:  
 $J_L = 0.94 \times 10^{-4} \text{kg} \cdot \text{m}^2$   
(with rubber coupling used)  
fs: Maximum starting pulse rate with no load



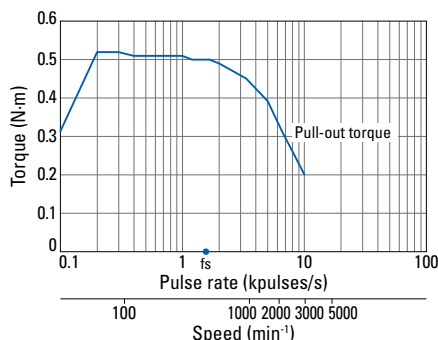
### SM2561C20U41 SM2561C20U11

Constant current circuit  
Input voltage: 24 VDC  
Winding current:  
2 A/phase  
At 2-phase excitation (full step)  
Pull-out torque:  
 $J_L = 0.94 \times 10^{-4} \text{kg} \cdot \text{m}^2$   
(with rubber coupling used)  
fs: Maximum starting pulse rate with no load



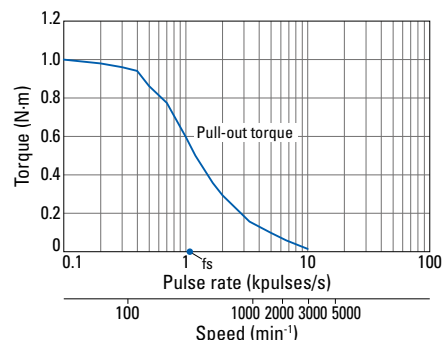
### SM2561C30U41 SM2561C30U11

Constant current circuit  
Input voltage: 24 VDC  
Winding current:  
3 A/phase  
At 2-phase excitation (full step)  
Pull-out torque:  
 $J_L = 0.94 \times 10^{-4} \text{kg} \cdot \text{m}^2$   
(with rubber coupling used)  
fs: Maximum starting pulse rate with no load



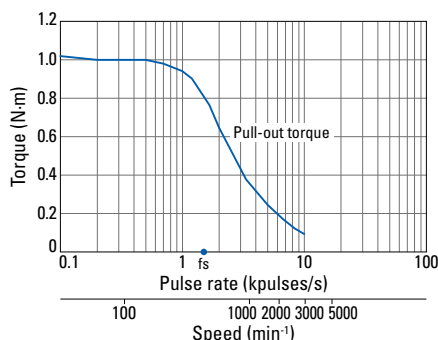
### SM2562C10U41 SM2562C10U11

Constant current circuit  
Input voltage: 24 VDC  
Winding current:  
1 A/phase  
At 2-phase excitation (full step)  
Pull-out torque:  
 $J_L = 2.6 \times 10^{-4} \text{kg} \cdot \text{m}^2$   
(with rubber coupling used)  
fs: Maximum starting pulse rate with no load



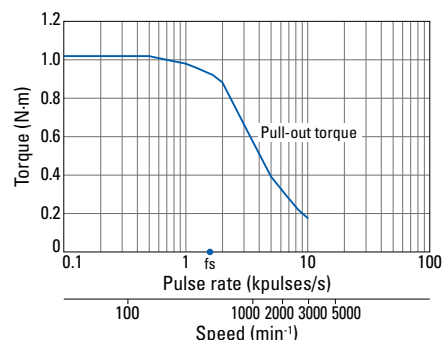
### SM2562C20U41 SM2562C20U11

Constant current circuit  
Input voltage: 24 VDC  
Winding current:  
2 A/phase  
At 2-phase excitation (full step)  
Pull-out torque:  
 $J_L = 2.6 \times 10^{-4} \text{kg} \cdot \text{m}^2$   
(with rubber coupling used)  
fs: Maximum starting pulse rate with no load



### SM2562C30U41 SM2562C30U11

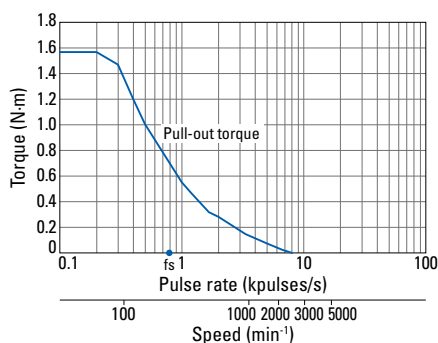
Constant current circuit  
Input voltage: 24 VDC  
Winding current:  
3 A/phase  
At 2-phase excitation (full step)  
Pull-out torque:  
 $J_L = 2.6 \times 10^{-4} \text{kg} \cdot \text{m}^2$   
(with rubber coupling used)  
fs: Maximum starting pulse rate with no load



## Characteristics

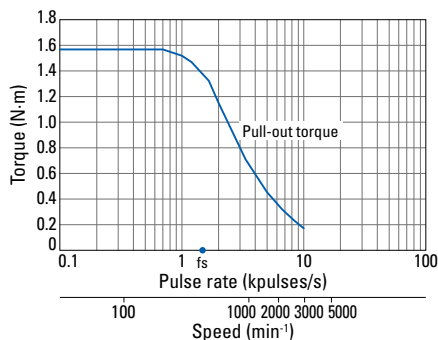
### SM2563C10U41 SM2563C10U11

Constant current circuit  
Input voltage: 24 VDC  
Winding current:  
1 A/phase  
At 2-phase excitation (full step)  
Pull-out torque:  
 $J_L = 7.4 \times 10^{-4} \text{ kg} \cdot \text{m}^2$   
(with rubber coupling used)  
 $f_s$ : Maximum starting pulse rate with no load



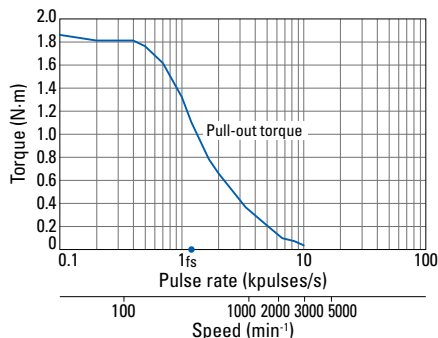
### SM2563C30U41 SM2563C30U11

Constant current circuit  
Input voltage: 24 VDC  
Winding current:  
3 A/phase  
At 2-phase excitation (full step)  
Pull-out torque:  
 $J_L = 7.4 \times 10^{-4} \text{ kg} \cdot \text{m}^2$   
(with rubber coupling used)  
 $f_s$ : Maximum starting pulse rate with no load



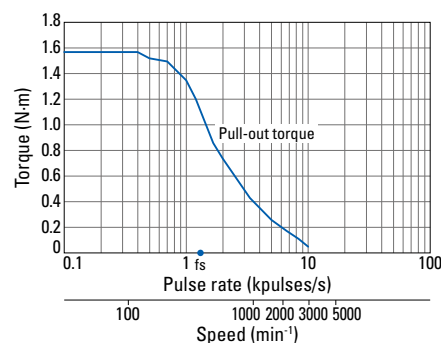
### SM2564C20U41 SM2564C20U11

Constant current circuit  
Input voltage: 24 VDC  
Winding current:  
2 A/phase  
At 2-phase excitation (full step)  
Pull-out torque:  
 $J_L = 7.4 \times 10^{-4} \text{ kg} \cdot \text{m}^2$   
(with rubber coupling used)  
 $f_s$ : Maximum starting pulse rate with no load



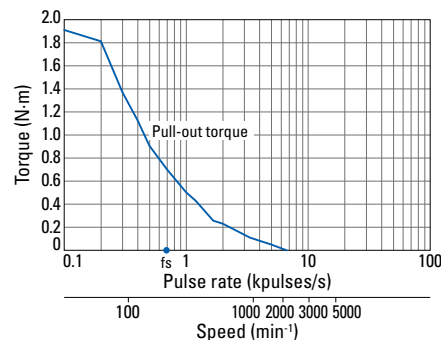
### SM2563C20U41 SM2563C20U11

Constant current circuit  
Input voltage: 24 VDC  
Winding current:  
2 A/phase  
At 2-phase excitation (full step)  
Pull-out torque:  
 $J_L = 7.4 \times 10^{-4} \text{ kg} \cdot \text{m}^2$   
(with rubber coupling used)  
 $f_s$ : Maximum starting pulse rate with no load



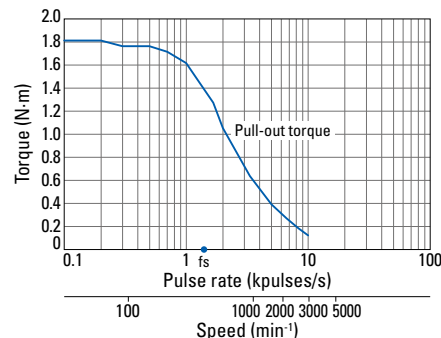
### SM2564C10U41 SM2564C10U11

Constant current circuit  
Input voltage: 24 VDC  
Winding current:  
1 A/phase  
At 2-phase excitation (full step)  
Pull-out torque:  
 $J_L = 7.4 \times 10^{-4} \text{ kg} \cdot \text{m}^2$   
(with rubber coupling used)  
 $f_s$ : Maximum starting pulse rate with no load

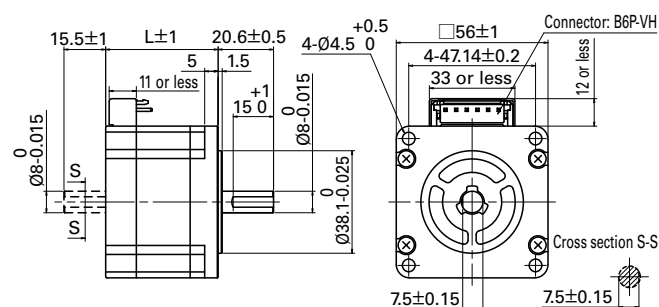


### SM2564C30U41 SM2564C30U11

Constant current circuit  
Input voltage: 24 VDC  
Winding current:  
3 A/phase  
At 2-phase excitation (full step)  
Pull-out torque:  
 $J_L = 7.4 \times 10^{-4} \text{ kg} \cdot \text{m}^2$   
(with rubber coupling used)  
 $f_s$ : Maximum starting pulse rate with no load



## Dimensions (Unit: mm)



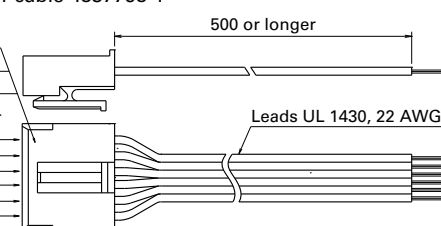
Separate option: Motor cable 4837798-1

Mfr.: J.S.T.

Housing: VHR-6N

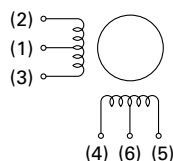
Terminal: SVH-21T-P1.1

| Terminal no. | Lead color |
|--------------|------------|
| 6            | Black      |
| 5            | Yellow     |
| 4            | Red        |
| 3            | Blue       |
| 2            | Orange     |
| 1            | White      |



## Internal wiring

In parentheses are connector pin nos.



## Compatible drivers

- For motors SM256□C20U□1 (2 A/phase)...

Model no.: US1D200P10 (DC input)

Operating current selection switch setting: 0

- For motors other than above...

A driver is to be provided by the customer.

Note: The characteristics shown above are calculated using our experimental circuit.

If considering replacing our conventional 56 mm sq. motors (103H712□),

→ See Models No Longer Listed and Their Replacement Models in p. 78 to 79



# 56 mm sq.

1.8°/step **RoHS**

Bipolar, connector type



## Custom options

Hollow shaft Custom shaft

Gear Encoder

Brake

Note: Customization feasibility depends on the model number and quantity. Contact us for details.

## Bipolar, connector type

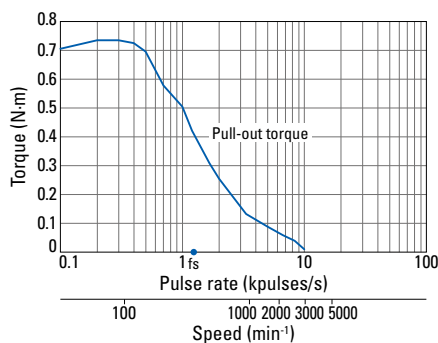
| Model no.           |                     | Holding torque<br>at 2-phase excitation | Rated<br>current | Winding<br>resistance | Winding inductance | Rotor<br>inertia                    | Mass | Motor<br>length (L) |
|---------------------|---------------------|-----------------------------------------|------------------|-----------------------|--------------------|-------------------------------------|------|---------------------|
| Single shaft        | Dual shaft          | N·m or more                             | A/phase          | Ω/phase               | mH/phase           | ×10 <sup>-4</sup> kg·m <sup>2</sup> | kg   | mm                  |
| <b>SM2561C10B41</b> | <b>SM2561C10B11</b> | 0.75                                    | 1                | 4.6                   | 13.5               | 0.14                                | 0.49 | 41.8                |
| <b>SM2561C20B41</b> | <b>SM2561C20B11</b> | 0.75                                    | 2                | 1.1                   | 3.5                | 0.14                                | 0.49 | 41.8                |
| <b>SM2561C30B41</b> | <b>SM2561C30B11</b> | 0.75                                    | 3                | 0.51                  | 1.5                | 0.14                                | 0.49 | 41.8                |
| <b>SM2561C40B41</b> | <b>SM2561C40B11</b> | 0.75                                    | 4                | 0.28                  | 0.85               | 0.14                                | 0.49 | 41.8                |
| <b>SM2561C60B41</b> | <b>SM2561C60B11</b> | 0.75                                    | 6                | 0.14                  | 0.38               | 0.14                                | 0.49 | 41.8                |
| <b>SM2562C10B41</b> | <b>SM2562C10B11</b> | 1.4                                     | 1                | 6.3                   | 25.5               | 0.28                                | 0.69 | 53.8                |
| <b>SM2562C20B41</b> | <b>SM2562C20B11</b> | 1.4                                     | 2                | 1.5                   | 6.5                | 0.28                                | 0.69 | 53.8                |
| <b>SM2562C30B41</b> | <b>SM2562C30B11</b> | 1.4                                     | 3                | 0.68                  | 2.9                | 0.28                                | 0.69 | 53.8                |
| <b>SM2562C40B41</b> | <b>SM2562C40B11</b> | 1.4                                     | 4                | 0.37                  | 1.5                | 0.28                                | 0.69 | 53.8                |
| <b>SM2562C60B41</b> | <b>SM2562C60B11</b> | 1.4                                     | 6                | 0.18                  | 0.72               | 0.28                                | 0.69 | 53.8                |
| <b>SM2563C10B41</b> | <b>SM2563C10B11</b> | 2.35                                    | 1                | 8.6                   | 36                 | 0.5                                 | 1.1  | 75.8                |
| <b>SM2563C20B41</b> | <b>SM2563C20B11</b> | 2.35                                    | 2                | 2.1                   | 9.5                | 0.5                                 | 1.1  | 75.8                |
| <b>SM2563C30B41</b> | <b>SM2563C30B11</b> | 2.35                                    | 3                | 0.95                  | 4.2                | 0.5                                 | 1.1  | 75.8                |
| <b>SM2563C40B41</b> | <b>SM2563C40B11</b> | 2.35                                    | 4                | 0.52                  | 2.4                | 0.5                                 | 1.1  | 75.8                |
| <b>SM2563C60B41</b> | <b>SM2563C60B11</b> | 2.35                                    | 6                | 0.25                  | 1.05               | 0.5                                 | 1.1  | 75.8                |
| <b>SM2564C10B41</b> | <b>SM2564C10B11</b> | 2.5                                     | 1                | 9.4                   | 41                 | 0.6                                 | 1.27 | 85.8                |
| <b>SM2564C20B41</b> | <b>SM2564C20B11</b> | 2.5                                     | 2                | 2.1                   | 11                 | 0.6                                 | 1.27 | 85.8                |
| <b>SM2564C30B41</b> | <b>SM2564C30B11</b> | 2.5                                     | 3                | 0.95                  | 4.9                | 0.6                                 | 1.27 | 85.8                |
| <b>SM2564C40B41</b> | <b>SM2564C40B11</b> | 2.5                                     | 4                | 0.59                  | 2.8                | 0.6                                 | 1.27 | 85.8                |
| <b>SM2564C60B41</b> | <b>SM2564C60B11</b> | 2.5                                     | 6                | 0.27                  | 1.15               | 0.6                                 | 1.27 | 85.8                |

Motor cable model no.: 4837961-1

## Characteristics

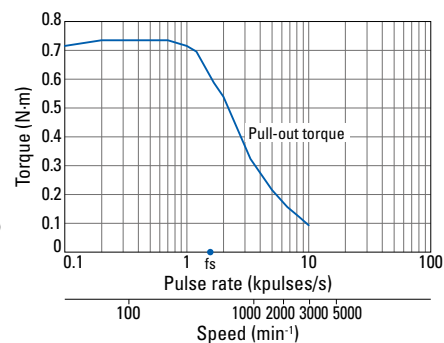
### SM2561C10B41 SM2561C10B11

Constant current circuit  
Input voltage: 24 VDC  
Winding current:  
1 A/phase  
At 2-phase excitation (full  
step)  
Pull-out torque:  
 $J_L = 0.94 \times 10^{-4} \text{kg} \cdot \text{m}^2$   
(with rubber coupling used)  
 $f_s$ : Maximum starting pulse  
rate with no load



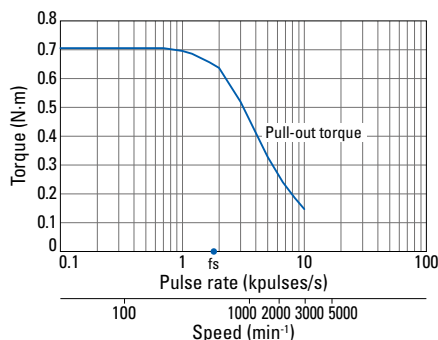
### SM2561C20B41 SM2561C20B11

Constant current circuit  
Input voltage: 24 VDC  
Winding current:  
2 A/phase  
At 2-phase excitation (full  
step)  
Pull-out torque:  
 $J_L = 0.94 \times 10^{-4} \text{kg} \cdot \text{m}^2$   
(with rubber coupling used)  
 $f_s$ : Maximum starting pulse  
rate with no load



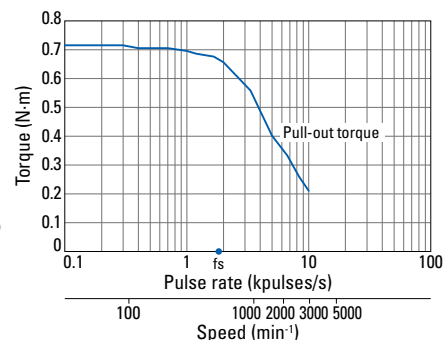
### SM2561C30B41 SM2561C30B11

Constant current circuit  
Input voltage: 24 VDC  
Winding current:  
3 A/phase  
At 2-phase excitation (full  
step)  
Pull-out torque:  
 $J_L = 0.94 \times 10^{-4} \text{kg} \cdot \text{m}^2$   
(with rubber coupling used)  
 $f_s$ : Maximum starting pulse  
rate with no load



### SM2561C40B41 SM2561C40B11

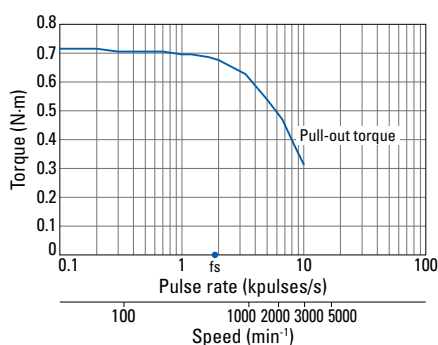
Constant current circuit  
Input voltage: 24 VDC  
Winding current:  
4 A/phase  
At 2-phase excitation (full  
step)  
Pull-out torque:  
 $J_L = 0.94 \times 10^{-4} \text{kg} \cdot \text{m}^2$   
(with rubber coupling used)  
 $f_s$ : Maximum starting pulse  
rate with no load



## Characteristics

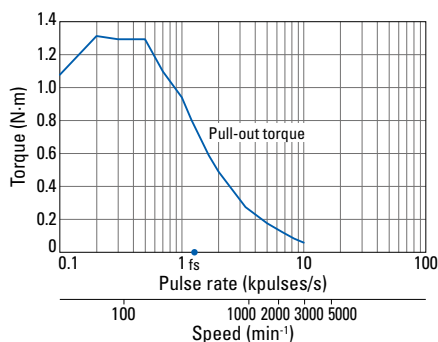
### SM2561C60B41 SM2561C60B11

Constant current circuit  
Input voltage: 24 VDC  
Winding current:  
6 A/phase  
At 2-phase excitation (full  
step)  
Pull-out torque:  
 $J_L = 0.94 \times 10^{-4} \text{ kg} \cdot \text{m}^2$   
(with rubber coupling used)  
 $f_s$ : Maximum starting pulse  
rate with no load



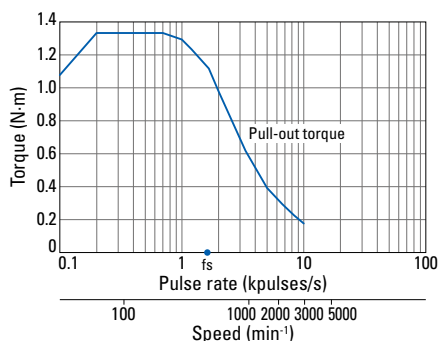
### SM2562C20B41 SM2562C20B11

Constant current circuit  
Input voltage: 24 VDC  
Winding current:  
2 A/phase  
At 2-phase excitation (full  
step)  
Pull-out torque:  
 $J_L = 2.6 \times 10^{-4} \text{ kg} \cdot \text{m}^2$   
(with rubber coupling used)  
 $f_s$ : Maximum starting pulse  
rate with no load



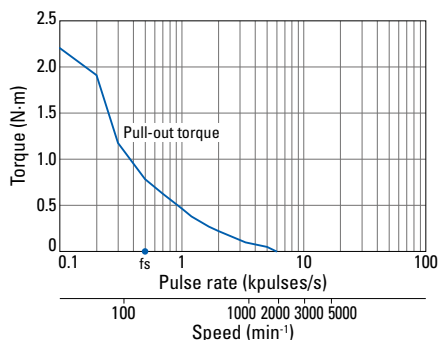
### SM2562C40B41 SM2562C40B11

Constant current circuit  
Input voltage: 24 VDC  
Winding current:  
4 A/phase  
At 2-phase excitation (full  
step)  
Pull-out torque:  
 $J_L = 2.6 \times 10^{-4} \text{ kg} \cdot \text{m}^2$   
(with rubber coupling used)  
 $f_s$ : Maximum starting pulse  
rate with no load



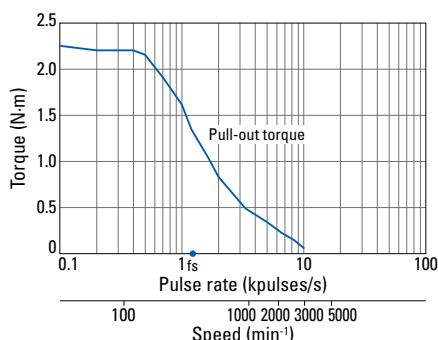
### SM2563C10B41 SM2563C10B11

Constant current circuit  
Input voltage: 24 VDC  
Winding current:  
1 A/phase  
At 2-phase excitation (full  
step)  
Pull-out torque:  
 $J_L = 7.4 \times 10^{-4} \text{ kg} \cdot \text{m}^2$   
(with rubber coupling used)  
 $f_s$ : Maximum starting pulse  
rate with no load



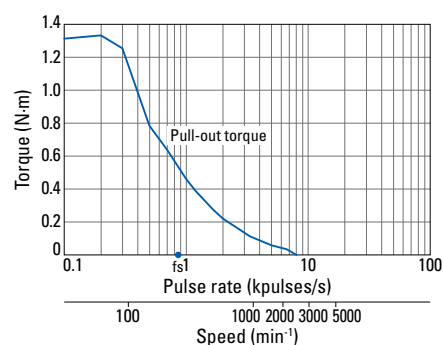
### SM2563C30B41 SM2563C30B11

Constant current circuit  
Input voltage: 24 VDC  
Winding current:  
3 A/phase  
At 2-phase excitation (full  
step)  
Pull-out torque:  
 $J_L = 7.4 \times 10^{-4} \text{ kg} \cdot \text{m}^2$   
(with rubber coupling used)  
 $f_s$ : Maximum starting pulse  
rate with no load



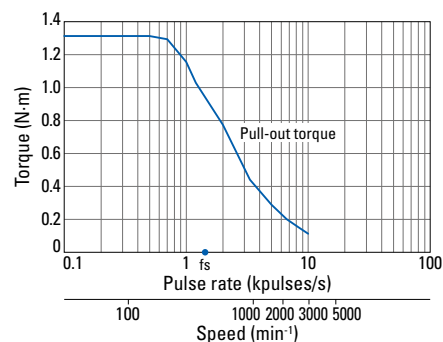
### SM2562C10B41 SM2562C10B11

Constant current circuit  
Input voltage: 24 VDC  
Winding current:  
1 A/phase  
At 2-phase excitation (full  
step)  
Pull-out torque:  
 $J_L = 2.6 \times 10^{-4} \text{ kg} \cdot \text{m}^2$   
(with rubber coupling used)  
 $f_s$ : Maximum starting pulse  
rate with no load



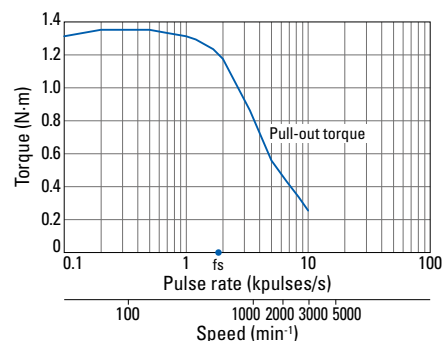
### SM2562C30B41 SM2562C30B11

Constant current circuit  
Input voltage: 24 VDC  
Winding current:  
3 A/phase  
At 2-phase excitation (full  
step)  
Pull-out torque:  
 $J_L = 2.6 \times 10^{-4} \text{ kg} \cdot \text{m}^2$   
(with rubber coupling used)  
 $f_s$ : Maximum starting pulse  
rate with no load



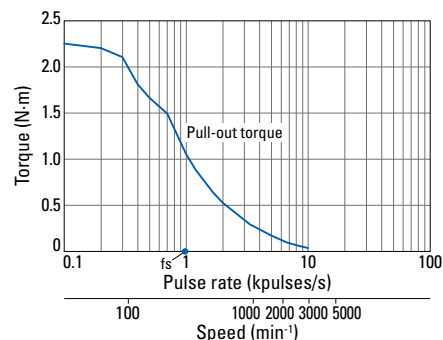
### SM2562C60B41 SM2562C60B11

Constant current circuit  
Input voltage: 24 VDC  
Winding current:  
6 A/phase  
At 2-phase excitation (full  
step)  
Pull-out torque:  
 $J_L = 2.6 \times 10^{-4} \text{ kg} \cdot \text{m}^2$   
(with rubber coupling used)  
 $f_s$ : Maximum starting pulse  
rate with no load



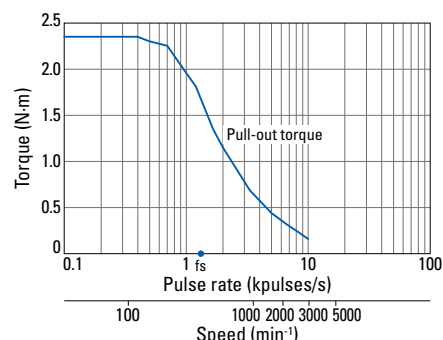
### SM2563C20B41 SM2563C20B11

Constant current circuit  
Input voltage: 24 VDC  
Winding current:  
2 A/phase  
At 2-phase excitation (full  
step)  
Pull-out torque:  
 $J_L = 7.4 \times 10^{-4} \text{ kg} \cdot \text{m}^2$   
(with rubber coupling used)  
 $f_s$ : Maximum starting pulse  
rate with no load



### SM2563C40B41 SM2563C40B11

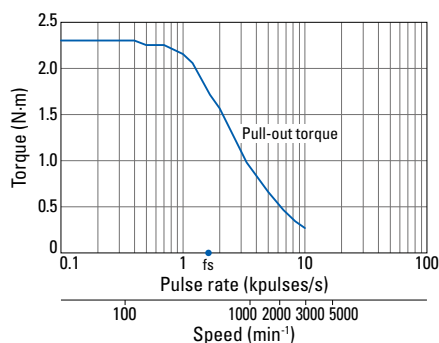
Constant current circuit  
Input voltage: 24 VDC  
Winding current:  
4 A/phase  
At 2-phase excitation (full  
step)  
Pull-out torque:  
 $J_L = 7.4 \times 10^{-4} \text{ kg} \cdot \text{m}^2$   
(with rubber coupling used)  
 $f_s$ : Maximum starting pulse  
rate with no load



## Characteristics

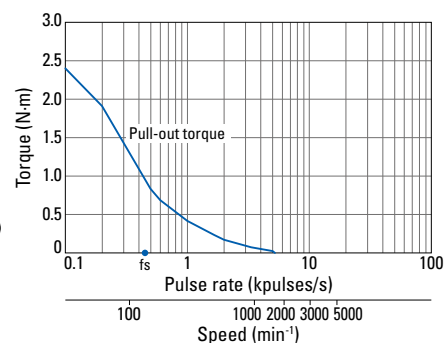
### SM2563C60B41 SM2563C60B11

Constant current circuit  
Input voltage: 24 VDC  
Winding current:  
6 A/phase  
At 2-phase excitation (full  
step)  
Pull-out torque:  
 $J_L = 7.4 \times 10^{-4} \text{ kg} \cdot \text{m}^2$   
(with rubber coupling used)  
 $f_s$ : Maximum starting pulse  
rate with no load



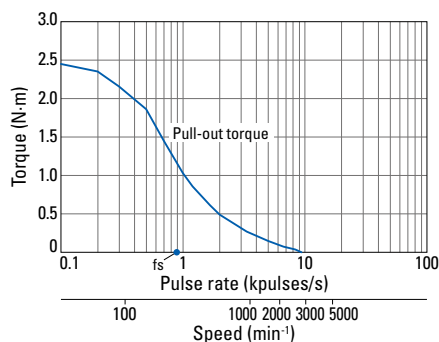
### SM2564C10B41 SM2564C10B11

Constant current circuit  
Input voltage: 24 VDC  
Winding current:  
1 A/phase  
At 2-phase excitation (full  
step)  
Pull-out torque:  
 $J_L = 7.4 \times 10^{-4} \text{ kg} \cdot \text{m}^2$   
(with rubber coupling used)  
 $f_s$ : Maximum starting pulse  
rate with no load



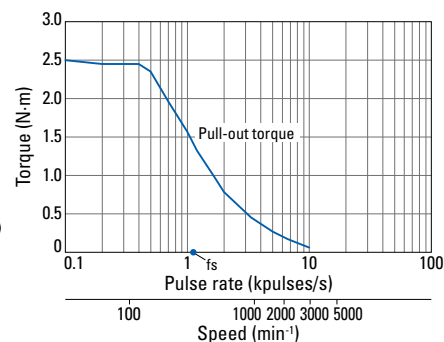
### SM2564C20B41 SM2564C20B11

Constant current circuit  
Input voltage: 24 VDC  
Winding current:  
2 A/phase  
At 2-phase excitation (full  
step)  
Pull-out torque:  
 $J_L = 7.4 \times 10^{-4} \text{ kg} \cdot \text{m}^2$   
(with rubber coupling used)  
 $f_s$ : Maximum starting pulse  
rate with no load



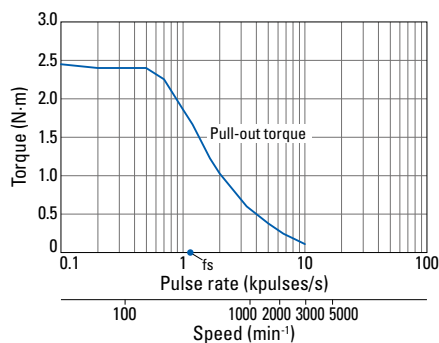
### SM2564C30B41 SM2564C30B11

Constant current circuit  
Input voltage: 24 VDC  
Winding current:  
3 A/phase  
At 2-phase excitation (full  
step)  
Pull-out torque:  
 $J_L = 7.4 \times 10^{-4} \text{ kg} \cdot \text{m}^2$   
(with rubber coupling used)  
 $f_s$ : Maximum starting pulse  
rate with no load



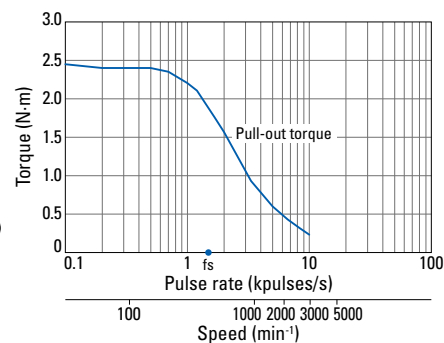
### SM2564C40B41 SM2564C40B11

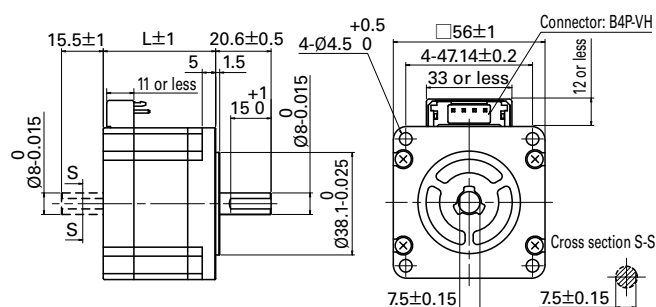
Constant current circuit  
Input voltage: 24 VDC  
Winding current:  
4 A/phase  
At 2-phase excitation (full  
step)  
Pull-out torque:  
 $J_L = 7.4 \times 10^{-4} \text{ kg} \cdot \text{m}^2$   
(with rubber coupling used)  
 $f_s$ : Maximum starting pulse  
rate with no load



### SM2564C60B41 SM2564C60B11

Constant current circuit  
Input voltage: 24 VDC  
Winding current:  
6 A/phase  
At 2-phase excitation (full  
step)  
Pull-out torque:  
 $J_L = 7.4 \times 10^{-4} \text{ kg} \cdot \text{m}^2$   
(with rubber coupling used)  
 $f_s$ : Maximum starting pulse  
rate with no load



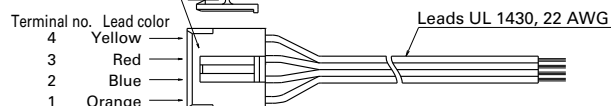
**Dimensions** (Unit: mm)

Separate option: Motor cable 4837961-1

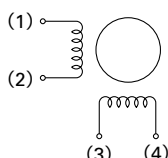
Mfr.: J.S.T.

Housing: VHR-4N

Terminal: SVH-21T-P1.1

**Internal wiring**

In parentheses are connector pin nos.

**Compatible drivers**

- For motors SM256□C20B□1 (2 A/phase)...

Model no.: BS1D200P10 (DC input)

Operating current selection switch setting: 0

- For motors other than above...

A driver is to be provided by the customer.

Note: The characteristics shown above are calculated using our experimental circuit.

**60 mm sq.**

Our conventional 60 mm sq. motors (103H782□)

1.8-phase step **RoHS**

It is recommended you use a 56 mm sq. motor (SM256□C□0□□1) that has equivalent torque in a smaller size. See Models No Longer Listed and Their Replacement Models in pages 78 to 79.

We also offer customization that makes the flange compatible with 60 mm sq. motors for easy replacement.

If considering replacing our conventional 56 mm sq. motors (103H712□),

→ See Models No Longer Listed and Their Replacement Models in p. 78 to 79





# 60 mm sq.

0.9°/step **RoHS**

Unipolar, lead type  
Bipolar, lead type



**Custom options**

Hollow shaft Custom shaft

Gear Encoder

Note: Customization feasibility depends on the model number and quantity. Contact us for details.

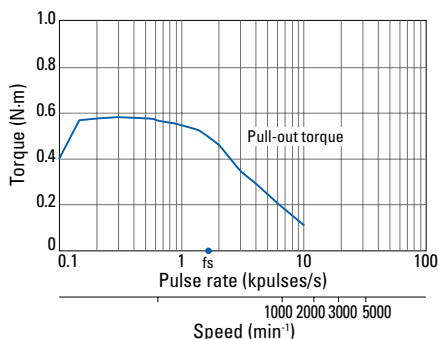
## Unipolar, lead type

| Model no.          |                    | Holding torque at 2-phase excitation | Rated current | Winding resistance | Winding inductance | Rotor inertia                       | Mass | Motor length (L) | Shaft diameter (D) |
|--------------------|--------------------|--------------------------------------|---------------|--------------------|--------------------|-------------------------------------|------|------------------|--------------------|
| Single shaft       | Dual shaft         | N·m or more                          | A/phase       | Ω/phase            | mH/phase           | ×10 <sup>-4</sup> kg·m <sup>2</sup> | kg   | mm               | mm                 |
| <b>SH1601-0440</b> | <b>SH1601-0410</b> | 0.57                                 | 2             | 1.35               | 2                  | 0.24                                | 0.55 | 42               | 0<br>ø6.35-0.013   |
| <b>SH1602-0440</b> | <b>SH1602-0410</b> | 1.1                                  | 2             | 1.8                | 3.5                | 0.4                                 | 0.8  | 54               | 0<br>ø6.35-0.013   |
| <b>SH1603-0440</b> | <b>SH1603-0410</b> | 1.7                                  | 2             | 2.3                | 4.5                | 0.75                                | 1.2  | 76               | 0<br>ø8-0.015      |

## Characteristics

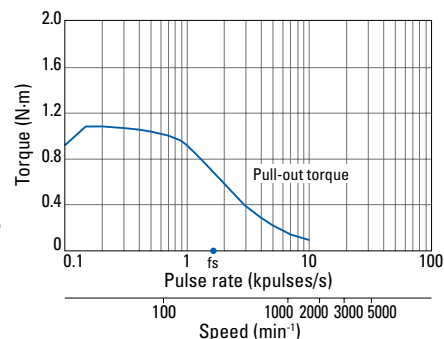
### SH1601-0440 SH1601-0410

Constant current circuit  
Input voltage: 24 VDC  
Winding current:  
2 A/phase  
At 2-phase excitation (full step)  
Pull-out torque:  
 $J_L = 0.94 \times 10^{-4} \text{kg} \cdot \text{m}^2$   
(with rubber coupling used)  
fs: Maximum starting pulse rate with no load



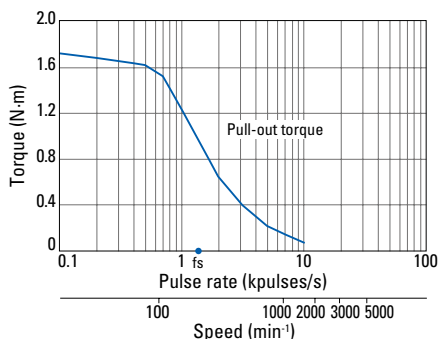
### SH1602-0440 SH1602-0410

Constant current circuit  
Input voltage: 24 VDC  
Winding current:  
2 A/phase  
At 2-phase excitation (full step)  
Pull-out torque:  
 $J_L = 2.6 \times 10^{-4} \text{kg} \cdot \text{m}^2$   
(with rubber coupling used)  
fs: Maximum starting pulse rate with no load

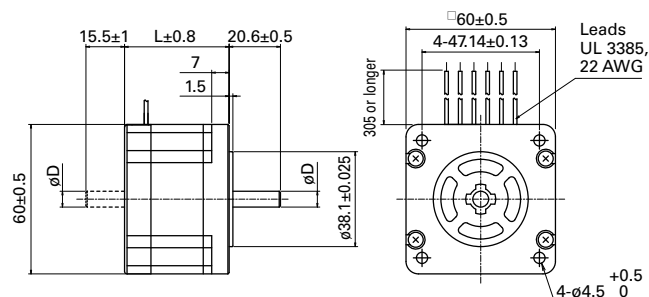


### SH1603-0440 SH1603-0410

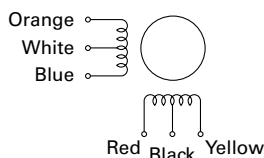
Constant current circuit  
Input voltage: 24 VDC  
Winding current:  
2 A/phase  
At 2-phase excitation (full step)  
Pull-out torque:  
 $J_L = 7.4 \times 10^{-4} \text{kg} \cdot \text{m}^2$   
(with rubber coupling used)  
fs: Maximum starting pulse rate with no load



## Dimensions (Unit: mm)



## Internal winding



## Compatible drivers

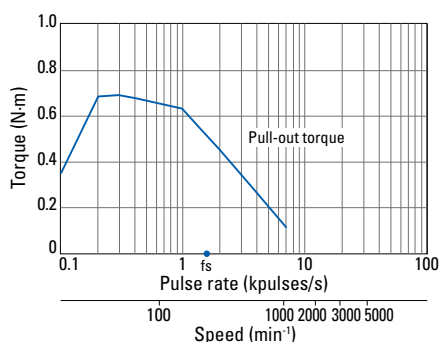
A driver is to be provided by the customer.

**Bipolar, lead type**

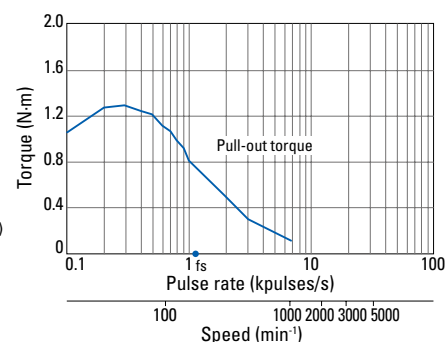
| Model no.          |                    | Holding torque<br>at 2-phase excitation | Rated<br>current | Winding<br>resistance | Winding<br>inductance | Rotor<br>inertia                    | Mass | Motor<br>length (L) | Shaft<br>diameter (D) |
|--------------------|--------------------|-----------------------------------------|------------------|-----------------------|-----------------------|-------------------------------------|------|---------------------|-----------------------|
| Single shaft       | Dual shaft         | N·m or more                             | A/phase          | Ω/phase               | mH/phase              | ×10 <sup>-4</sup> kg·m <sup>2</sup> | kg   | mm                  | mm                    |
| <b>SH1601-5240</b> | <b>SH1601-5210</b> | 0.69                                    | 2                | 1.2                   | 3.5                   | 0.24                                | 0.55 | 42                  | 0<br>ø6.35-0.013      |
| <b>SH1602-5240</b> | <b>SH1602-5210</b> | 1.28                                    | 2                | 1.65                  | 6.1                   | 0.4                                 | 0.8  | 54                  | 0<br>ø6.35-0.013      |
| <b>SH1603-5240</b> | <b>SH1603-5210</b> | 2.15                                    | 2                | 2.3                   | 8.8                   | 0.75                                | 1.2  | 76                  | 0<br>ø8-0.015         |

**Characteristics****SH1601-5240  
SH1601-5210**

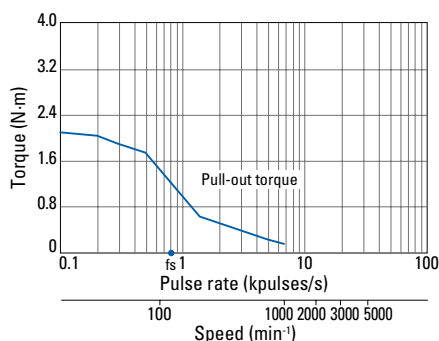
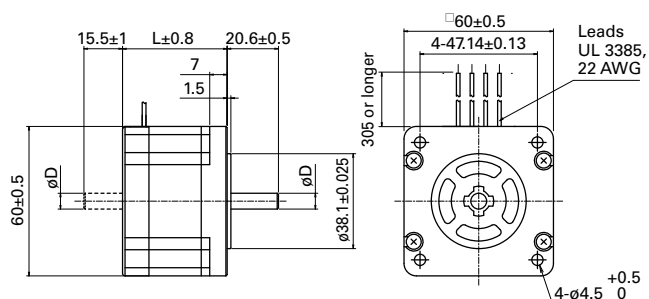
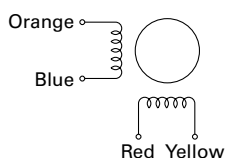
Constant current circuit  
Input voltage: 24 VDC  
Winding current:  
2 A/phase  
At 2-phase excitation (full  
step)  
Pull-out torque:  
 $J_L = 0.94 \times 10^{-4} \text{kg} \cdot \text{m}^2$   
(with rubber coupling used)  
fs: Maximum starting pulse  
rate with no load

**SH1602-5240  
SH1602-5210**

Constant current circuit  
Input voltage: 24 VDC  
Winding current:  
2 A/phase  
At 2-phase excitation (full  
step)  
Pull-out torque:  
 $J_L = 2.6 \times 10^{-4} \text{kg} \cdot \text{m}^2$   
(with rubber coupling used)  
fs: Maximum starting pulse  
rate with no load

**SH1603-5240  
SH1603-5210**

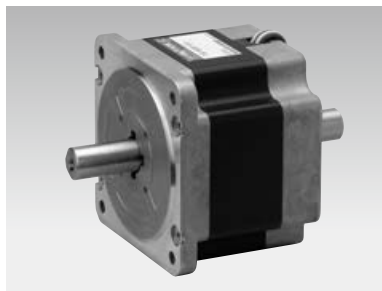
Constant current circuit  
Input voltage: 24 VDC  
Winding current:  
2 A/phase  
At 2-phase excitation (full  
step)  
Pull-out torque:  
 $J_L = 7.4 \times 10^{-4} \text{kg} \cdot \text{m}^2$   
(with rubber coupling used)  
fs: Maximum starting pulse  
rate with no load

**Dimensions (Unit: mm)****Internal winding****Compatible drivers**

Model no.: BS1D200P10 (DC input)

Operating current selection switch setting: 0

Note: The characteristics shown above are calculated using our experimental circuit.



# 86 mm sq.

1.8°/step **RoHS**

Unipolar, lead type  
Bipolar, lead type ▶ p. 60



**Custom options**

Hollow shaft Custom shaft  
Encoder Brake

Note: Customization feasibility depends on the model number and quantity. Contact us for details.

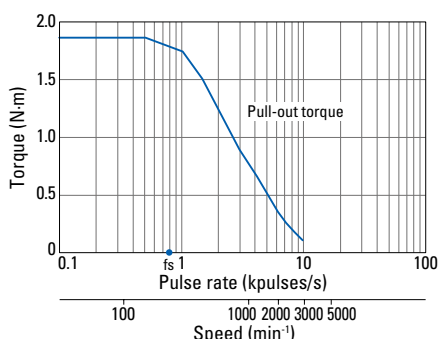
## Unipolar, lead type

| Model no.    |             | Holding torque at 2-phase excitation | Rated current | Winding resistance | Winding inductance | Rotor inertia                       | Mass | Motor length (L) |
|--------------|-------------|--------------------------------------|---------------|--------------------|--------------------|-------------------------------------|------|------------------|
| Single shaft | Dual shaft  | N·m or more                          | A/phase       | Ω/phase            | mH/phase           | ×10 <sup>-4</sup> kg·m <sup>2</sup> | kg   | mm               |
| SH2861-0441  | SH2861-0411 | 2.5                                  | 2             | 2.3                | 8.0                | 1.48                                | 1.75 | 66               |
| SH2861-0941  | SH2861-0911 | 2.5                                  | 4             | 0.6                | 2.0                | 1.48                                | 1.75 | 66               |
| SH2862-0441  | SH2862-0411 | 4.7                                  | 2             | 3.2                | 13.0               | 3.0                                 | 2.9  | 96.5             |
| SH2862-0941  | SH2862-0911 | 4.7                                  | 4             | 0.85               | 3.4                | 3.0                                 | 2.9  | 96.5             |
| SH2863-0441  | SH2863-0411 | 6.7                                  | 2             | 4.0                | 17.0               | 4.5                                 | 4.0  | 127              |
| SH2863-0941  | SH2863-0911 | 6.7                                  | 4             | 0.9                | 4.2                | 4.5                                 | 4.0  | 127              |

## Characteristics

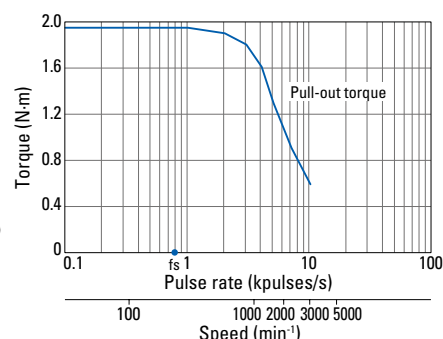
### SH2861-0441 SH2861-0411

Constant current circuit  
Input voltage: 100 VAC  
Winding current:  
2 A/phase  
At 2-phase excitation (full step)  
Pull-out torque:  
 $J_L = 7.4 \times 10^{-4} \text{kg} \cdot \text{m}^2$   
(with rubber coupling used)  
 $f_s$ : Maximum starting pulse rate with no load



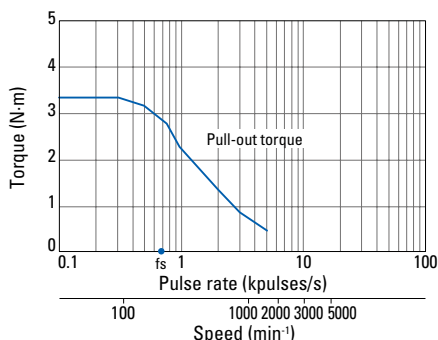
### SH2861-0941 SH2861-0911

Constant current circuit  
Input voltage: 100 VAC  
Winding current:  
4 A/phase  
At 2-phase excitation (full step)  
Pull-out torque:  
 $J_L = 7.4 \times 10^{-4} \text{kg} \cdot \text{m}^2$   
(with rubber coupling used)  
 $f_s$ : Maximum starting pulse rate with no load



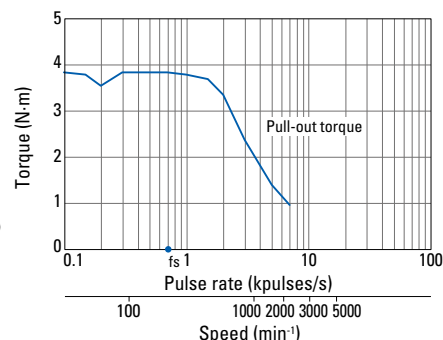
### SH2862-0441 SH2862-0411

Constant current circuit  
Input voltage: 100 VAC  
Winding current:  
2 A/phase  
At 2-phase excitation (full step)  
Pull-out torque:  
 $J_L = 15.3 \times 10^{-4} \text{kg} \cdot \text{m}^2$   
(with rubber coupling used)  
 $f_s$ : Maximum starting pulse rate with no load



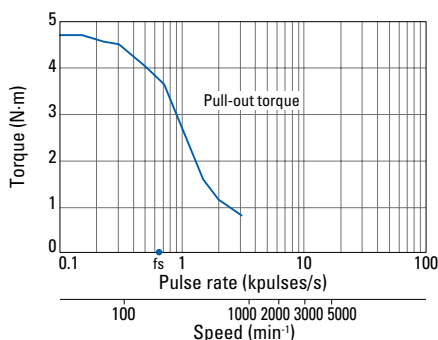
### SH2862-0941 SH2862-0911

Constant current circuit  
Input voltage: 100 VAC  
Winding current:  
4 A/phase  
At 2-phase excitation (full step)  
Pull-out torque:  
 $J_L = 15.3 \times 10^{-4} \text{kg} \cdot \text{m}^2$   
(with rubber coupling used)  
 $f_s$ : Maximum starting pulse rate with no load



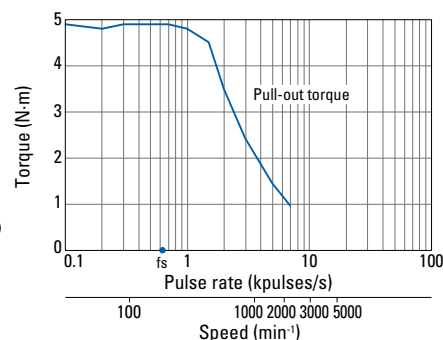
### SH2863-0441 SH2863-0411

Constant current circuit  
Input voltage: 100 VAC  
Winding current:  
2 A/phase  
At 2-phase excitation (full step)  
Pull-out torque:  
 $J_L = 15.3 \times 10^{-4} \text{kg} \cdot \text{m}^2$   
(with rubber coupling used)  
 $f_s$ : Maximum starting pulse rate with no load



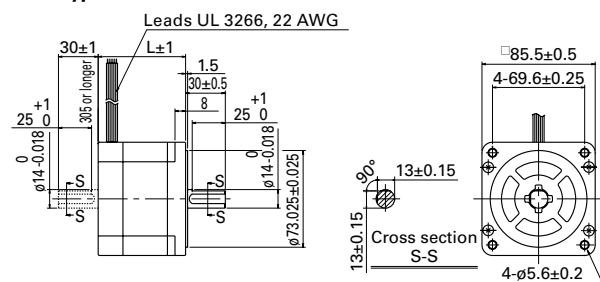
### SH2863-0941 SH2863-0911

Constant current circuit  
Input voltage: 100 VAC  
Winding current:  
4 A/phase  
At 2-phase excitation (full step)  
Pull-out torque:  
 $J_L = 15.3 \times 10^{-4} \text{kg} \cdot \text{m}^2$   
(with rubber coupling used)  
 $f_s$ : Maximum starting pulse rate with no load

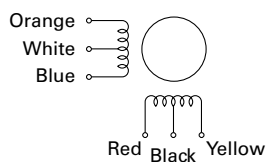


### ■ Dimensions (Unit: mm)

### Lead type

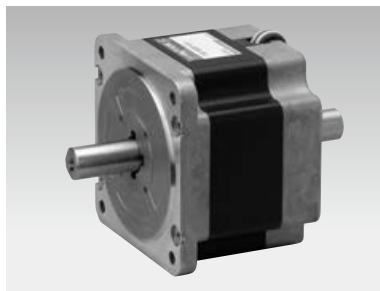


## Internal winding



## Compatible drivers

A driver is to be provided by the customer.



# 86 mm sq.

1.8°/step **RoHS**

Bipolar, lead type

Unipolar, lead type ▶ p. 58



**Custom options**

Hollow shaft Custom shaft

Encoder Brake

Note: Customization feasibility depends on the model number and quantity. Contact us for details.

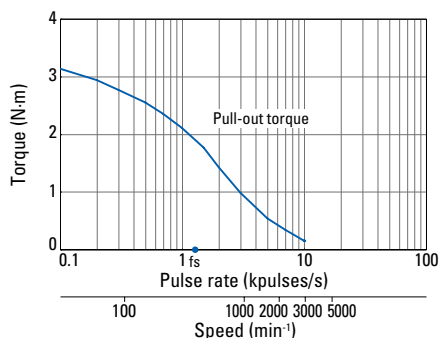
## Bipolar, lead type

| Model no.    |             | Holding torque at 2-phase excitation | Rated current | Winding resistance | Winding inductance | Rotor inertia                        | Mass | Motor length (L) |
|--------------|-------------|--------------------------------------|---------------|--------------------|--------------------|--------------------------------------|------|------------------|
| Single shaft | Dual shaft  | N·m or more                          | A/phase       | Ω/phase            | mH/phase           | ×10 <sup>-4</sup> ·kg·m <sup>2</sup> | kg   | mm               |
| SH2861-5041  | SH2861-5011 | 3.3                                  | 2             | 2.2                | 15                 | 1.48                                 | 1.75 | 66               |
| SH2861-5141  | SH2861-5111 | 3.3                                  | 4             | 0.56               | 3.7                | 1.48                                 | 1.75 | 66               |
| SH2861-5241  | SH2861-5211 | 3.3                                  | 6             | 0.29               | 1.7                | 1.48                                 | 1.75 | 66               |
| SH2862-5041  | SH2862-5011 | 6.4                                  | 2             | 3.2                | 25                 | 3.0                                  | 2.9  | 96.5             |
| SH2862-5141  | SH2862-5111 | 6.4                                  | 4             | 0.83               | 6.4                | 3.0                                  | 2.9  | 96.5             |
| SH2862-5241  | SH2862-5211 | 6.4                                  | 6             | 0.36               | 2.8                | 3.0                                  | 2.9  | 96.5             |
| SH2863-5041  | SH2863-5011 | 9                                    | 2             | 4.0                | 32                 | 4.5                                  | 4.0  | 127              |
| SH2863-5141  | SH2863-5111 | 9                                    | 4             | 1.0                | 7.9                | 4.5                                  | 4.0  | 127              |
| SH2863-5241  | SH2863-5211 | 9                                    | 6             | 0.46               | 3.8                | 4.5                                  | 4.0  | 127              |

## Characteristics

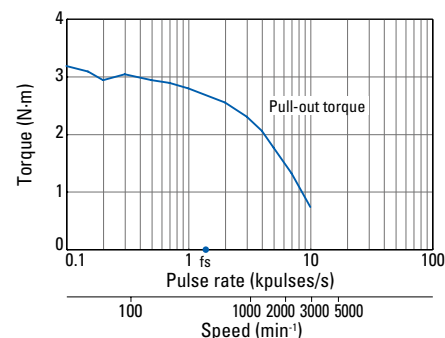
### SH2861-5041 SH2861-5011

Constant current circuit  
Input voltage: 100 VAC  
Winding current:  
2 A/phase  
At 2-phase excitation (full step)  
Pull-out torque:  
 $J_L = 15.3 \times 10^{-4} \text{ kg} \cdot \text{m}^2$   
(with rubber coupling used)  
 $f_s$ : Maximum starting pulse rate with no load



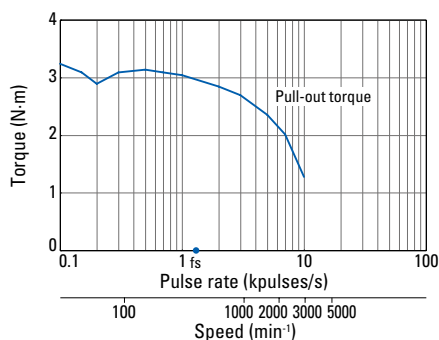
### SH2861-5141 SH2861-5111

Constant current circuit  
Input voltage: 100 VAC  
Winding current:  
4 A/phase  
At 2-phase excitation (full step)  
Pull-out torque:  
 $J_L = 15.3 \times 10^{-4} \text{ kg} \cdot \text{m}^2$   
(with rubber coupling used)  
 $f_s$ : Maximum starting pulse rate with no load



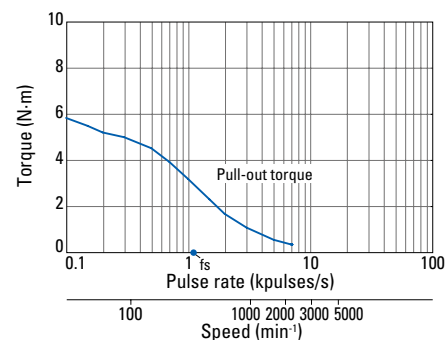
### SH2861-5241 SH2861-5211

Constant current circuit  
Input voltage: 100 VAC  
Winding current:  
6 A/phase  
At 2-phase excitation (full step)  
Pull-out torque:  
 $J_L = 15.3 \times 10^{-4} \text{ kg} \cdot \text{m}^2$   
(with rubber coupling used)  
 $f_s$ : Maximum starting pulse rate with no load



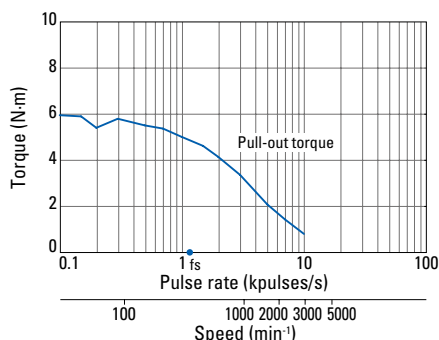
### SH2862-5041 SH2862-5011

Constant current circuit  
Input voltage: 100 VAC  
Winding current:  
2 A/phase  
At 2-phase excitation (full step)  
Pull-out torque:  
 $J_L = 15.3 \times 10^{-4} \text{ kg} \cdot \text{m}^2$   
(with rubber coupling used)  
 $f_s$ : Maximum starting pulse rate with no load



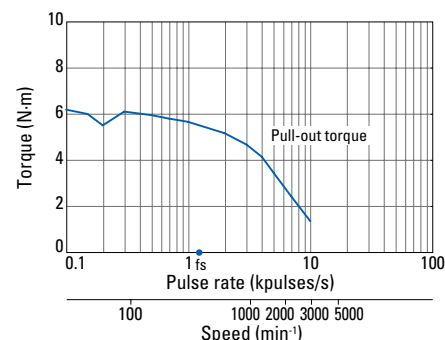
### SH2862-5141 SH2862-5111

Constant current circuit  
Input voltage: 100 VAC  
Winding current:  
4 A/phase  
At 2-phase excitation (full step)  
Pull-out torque:  
 $J_L = 15.3 \times 10^{-4} \text{ kg} \cdot \text{m}^2$   
(with rubber coupling used)  
 $f_s$ : Maximum starting pulse rate with no load



### SH2862-5241 SH2862-5211

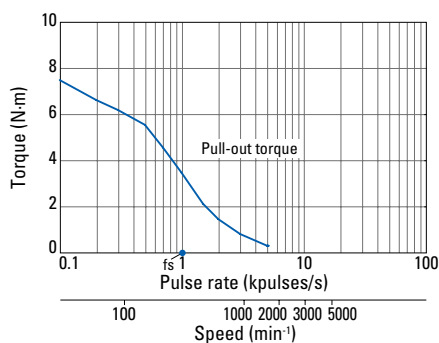
Constant current circuit  
Input voltage: 100 VAC  
Winding current:  
6 A/phase  
At 2-phase excitation (full step)  
Pull-out torque:  
 $J_L = 15.3 \times 10^{-4} \text{ kg} \cdot \text{m}^2$   
(with rubber coupling used)  
 $f_s$ : Maximum starting pulse rate with no load



## Characteristics

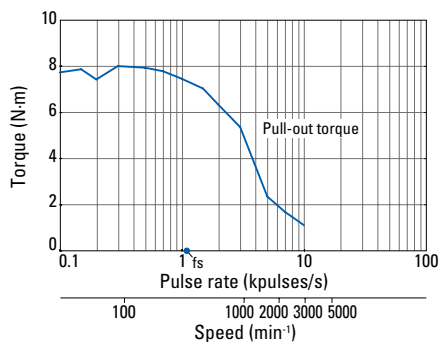
SH2863-5041  
SH2863-5011

Constant current circuit  
Input voltage: 100 VAC  
Winding current:  
2 A/phase  
At 2-phase excitation (full  
step)  
Pull-out torque:  
 $J_L = 44 \times 10^{-4} \text{ kg} \cdot \text{m}^2$   
(with rubber coupling  
used)  
fs: Maximum starting pulse  
rate with no load



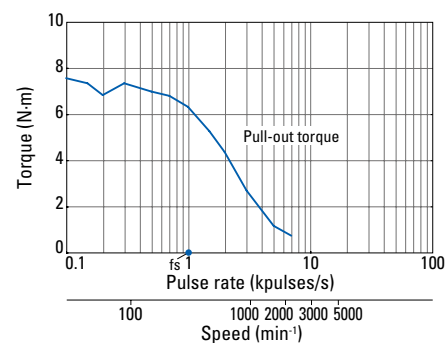
SH2863-5241  
SH2863-5211

Constant current circuit  
Input voltage: 100 VAC  
Winding current:  
6 A/phase  
At 2-phase excitation (full  
step)  
Pull-out torque:  
 $J_L = 44 \times 10^{-4} \text{ kg} \cdot \text{m}^2$   
(with rubber coupling  
used)  
fs: Maximum starting pulse  
rate with no load

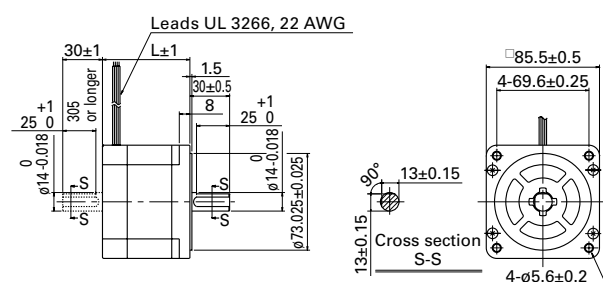


SH2863-5141  
SH2863-5111

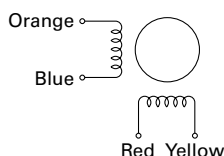
Constant current circuit  
Input voltage: 100 VAC  
Winding current:  
4 A/phase  
At 2-phase excitation (full  
step)  
Pull-out torque:  
 $J_L = 44 \times 10^{-4} \text{ kg} \cdot \text{m}^2$   
(with rubber coupling  
used)  
fs: Maximum starting pulse  
rate with no load



### ■ Dimensions (Unit: mm)



## Internal winding



## Compatible drivers

A driver is to be provided by the customer.



# ø106 mm

1.8°/step **RoHS**

Unipolar, lead type  
Bipolar, lead type

## Custom options

Hollow shaft Custom shaft  
Brake

Note: Customization feasibility depends on the model number and quantity. Contact us for details.

## Unipolar, lead type

| Model no.      |                | Holding torque at 2-phase excitation | Rated current | Winding resistance | Winding inductance | Rotor inertia                       | Mass | Motor length (L) |
|----------------|----------------|--------------------------------------|---------------|--------------------|--------------------|-------------------------------------|------|------------------|
| Single shaft   | Dual shaft     | N·m or more                          | A/phase       | Ω/phase            | mH/phase           | ×10 <sup>-4</sup> kg·m <sup>2</sup> | kg   | mm               |
| 103H89222-0941 | 103H89222-0911 | 10.8                                 | 4             | 0.98               | 6.3                | 14.6                                | 7.5  | 163.3            |
| 103H89223-0941 | 103H89223-0911 | 15.5                                 | 4             | 1.4                | 9.7                | 22                                  | 10.5 | 221.3            |

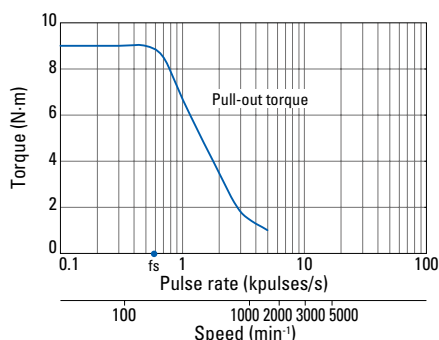
## Bipolar, lead type

| Model no.      |                | Holding torque at 2-phase excitation | Rated current | Winding resistance | Winding inductance | Rotor inertia                       | Mass | Motor length (L) |
|----------------|----------------|--------------------------------------|---------------|--------------------|--------------------|-------------------------------------|------|------------------|
| Single shaft   | Dual shaft     | N·m or more                          | A/phase       | Ω/phase            | mH/phase           | ×10 <sup>-4</sup> kg·m <sup>2</sup> | kg   | mm               |
| 103H89222-5241 | 103H89222-5211 | 13.2                                 | 6             | 0.45               | 5.4                | 14.6                                | 7.5  | 163.3            |
| 103H89223-5241 | 103H89223-5211 | 19                                   | 6             | 0.63               | 8                  | 22                                  | 10.5 | 221.3            |

## Characteristics

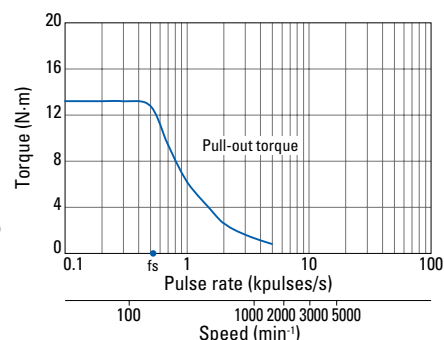
### 103H89222-0941 103H89222-0911

Constant current circuit  
Input voltage: 100 VAC  
Winding current:  
4 A/phase  
At 2-phase excitation (full step)  
Pull-out torque:  
 $J_L = 44 \times 10^{-4} \text{kg} \cdot \text{m}^2$   
(with rubber coupling used)  
 $f_s$ : Maximum starting pulse rate with no load



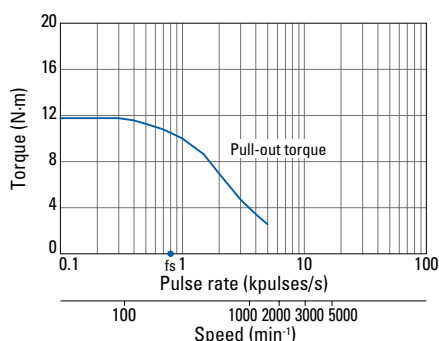
### 103H89223-0941 103H89223-0911

Constant current circuit  
Input voltage: 100 VAC  
Winding current:  
4 A/phase  
At 2-phase excitation (full step)  
Pull-out torque:  
 $J_L = 44 \times 10^{-4} \text{kg} \cdot \text{m}^2$   
(with rubber coupling used)  
 $f_s$ : Maximum starting pulse rate with no load



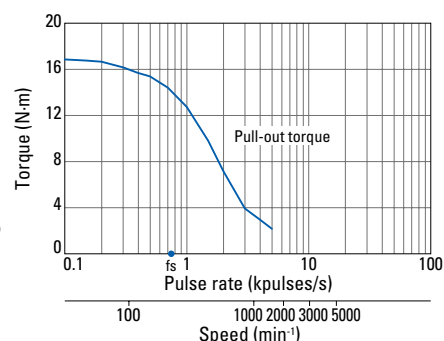
### 103H89222-5241 103H89222-5211

Constant current circuit  
Input voltage: 100 VAC  
Winding current:  
6 A/phase  
At 2-phase excitation (full step)  
Pull-out torque:  
 $J_L = 44 \times 10^{-4} \text{kg} \cdot \text{m}^2$   
(with rubber coupling used)  
 $f_s$ : Maximum starting pulse rate with no load

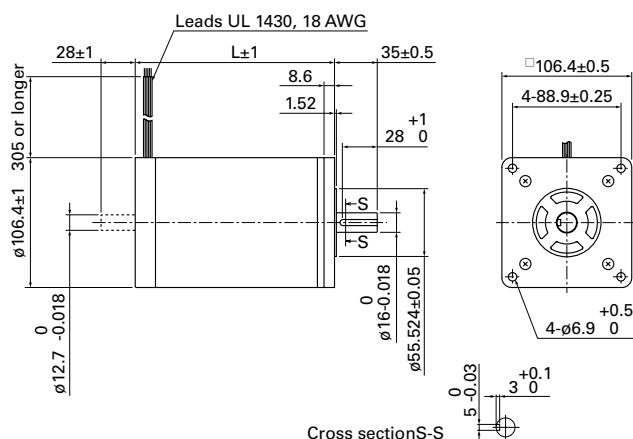


### 103H89223-5241 103H89223-5211

Constant current circuit  
Input voltage: 100 VAC  
Winding current:  
6 A/phase  
At 2-phase excitation (full step)  
Pull-out torque:  
 $J_L = 44 \times 10^{-4} \text{kg} \cdot \text{m}^2$   
(with rubber coupling used)  
 $f_s$ : Maximum starting pulse rate with no load

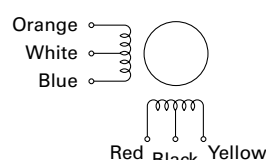


## Dimensions (Unit: mm)

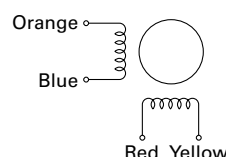


## Internal winding

### Unipolar



### Bipolar



## Compatible drivers

A driver is to be provided by the customer.





# 56 mm sq.

1.8°/step **RoHS**

Unipolar, lead-type, CE models



## Custom options

Hollow shaft Custom shaft

Note: Customization feasibility depends on the model number and quantity. Contact us for details.

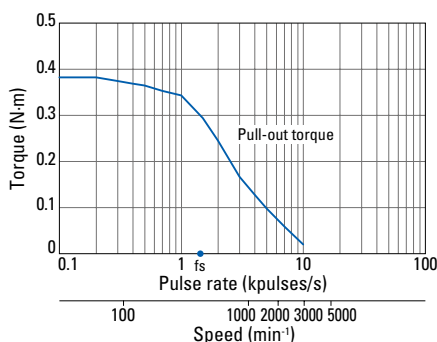
## Unipolar, lead-type, CE models

| Model no.     |               | Holding torque<br>at 2-phase excitation | Rated<br>current | Winding<br>resistance | Winding inductance | Rotor<br>inertia                    | Mass | Motor<br>length (L) |
|---------------|---------------|-----------------------------------------|------------------|-----------------------|--------------------|-------------------------------------|------|---------------------|
| Single shaft  | Dual shaft    | N·m or more                             | A/phase          | Ω/phase               | mH/phase           | ×10 <sup>-4</sup> kg·m <sup>2</sup> | kg   | mm                  |
| 103H7121-6140 | 103H7121-6110 | 0.39                                    | 1                | 4.8                   | 8                  | 0.1                                 | 0.47 | 41.8                |
| 103H7121-6740 | 103H7121-6710 | 0.39                                    | 3                | 0.6                   | 0.8                | 0.1                                 | 0.47 | 41.8                |
| 103H7123-6140 | 103H7123-6110 | 0.83                                    | 1                | 6.7                   | 15                 | 0.21                                | 0.65 | 53.8                |
| 103H7123-6740 | 103H7123-6710 | 0.78                                    | 3                | 0.77                  | 1.58               | 0.21                                | 0.65 | 53.8                |
| 103H7126-6140 | 103H7126-6110 | 1.27                                    | 1                | 8.6                   | 19                 | 0.36                                | 0.98 | 75.8                |
| 103H7126-6740 | 103H7126-6710 | 1.27                                    | 3                | 0.9                   | 2.2                | 0.36                                | 0.98 | 75.8                |

## Characteristics

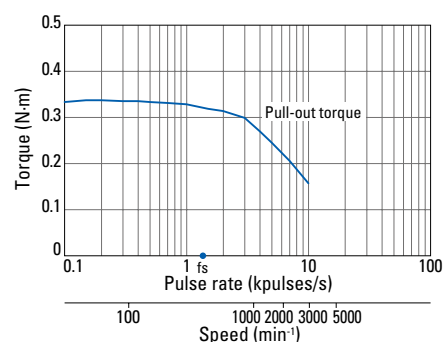
### 103H7121-6140 103H7121-6110

Constant current circuit  
Input voltage: 24 VDC  
Winding current:  
1 A/phase  
At 2-phase excitation (full  
step)  
Pull-out torque:  
 $J_L = 0.94 \times 10^{-4} \text{kg} \cdot \text{m}^2$   
(with rubber coupling used)  
fs: Maximum starting pulse  
rate with no load



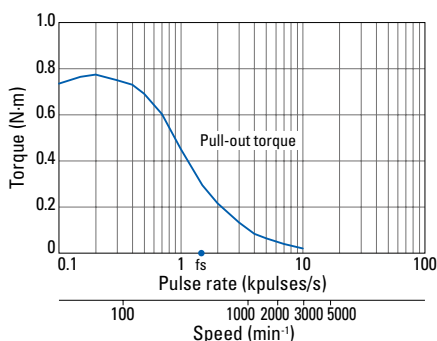
### 103H7121-6740 103H7121-6710

Constant current circuit  
Input voltage: 24 VDC  
Winding current:  
3 A/phase  
At 2-phase excitation (full  
step)  
Pull-out torque:  
 $J_L = 0.94 \times 10^{-4} \text{kg} \cdot \text{m}^2$   
(with rubber coupling used)  
fs: Maximum starting pulse  
rate with no load



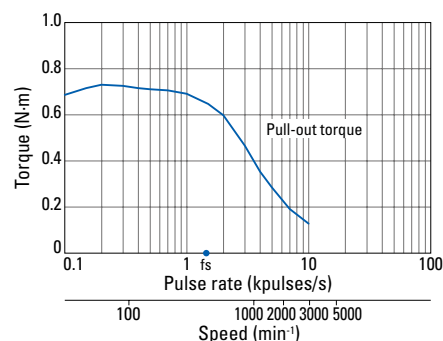
### 103H7123-6140 103H7123-6110

Constant current circuit  
Input voltage: 24 VDC  
Winding current:  
1 A/phase  
At 2-phase excitation (full  
step)  
Pull-out torque:  
 $J_L = 0.94 \times 10^{-4} \text{kg} \cdot \text{m}^2$   
(with rubber coupling used)  
fs: Maximum starting pulse  
rate with no load



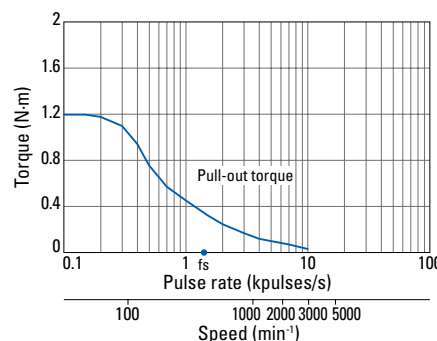
### 103H7123-6740 103H7123-6710

Constant current circuit  
Input voltage: 24 VDC  
Winding current:  
3 A/phase  
At 2-phase excitation (full  
step)  
Pull-out torque:  
 $J_L = 0.94 \times 10^{-4} \text{kg} \cdot \text{m}^2$   
(with rubber coupling used)  
fs: Maximum starting pulse  
rate with no load



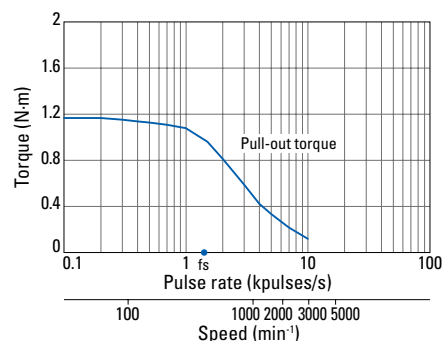
### 103H7126-6140 103H7126-6110

Constant current circuit  
Input voltage: 24 VDC  
Winding current:  
1 A/phase  
At 2-phase excitation (full  
step)  
Pull-out torque:  
 $J_L = 2.6 \times 10^{-4} \text{kg} \cdot \text{m}^2$   
(with rubber coupling used)  
fs: Maximum starting pulse  
rate with no load

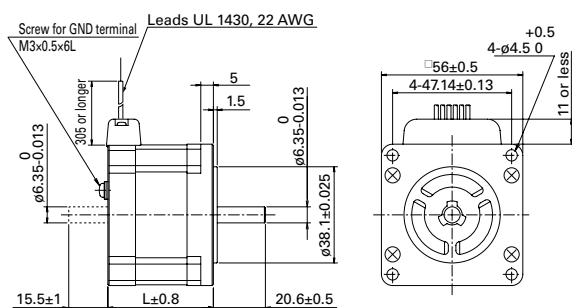


### 103H7126-6740 103H7126-6710

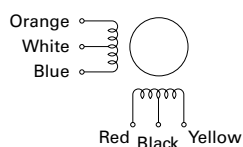
Constant current circuit  
Input voltage: 24 VDC  
Winding current:  
3 A/phase  
At 2-phase excitation (full  
step)  
Pull-out torque:  
 $J_L = 2.6 \times 10^{-4} \text{kg} \cdot \text{m}^2$   
(with rubber coupling used)  
fs: Maximum starting pulse  
rate with no load



## Dimensions (Unit: mm)



## Internal winding



## Compatible drivers

• For motors 103H712 □ -61 □ 0 (1 A/phase)...

Model no.: US1D200P10 (DC input)

Operating current selection switch setting: A

• For motors other than above...

A driver is to be provided by the customer.

Note: The characteristics shown above are calculated using our experimental circuit.

Allowable loads... ▶ p. 69 Internal wiring and rotational directions... ▶ p. 70

General specifications... ▶ p. 71

Data is measured under the drive conditions of SANYO DENKI. Drive torque may vary depending on the actual machine precision.



# 86 mm sq.

1.8°/step **RoHS**

Unipolar, lead-type, CE/UL models

Bipolar, lead-type, CE/UL models ▶ p. 66

Bipolar, terminal block-type, CE/UL models ▶ p. 66



**Custom options**

**Hollow shaft** **Custom shaft**

Note: Customization feasibility depends on the model number and quantity. Contact us for details.

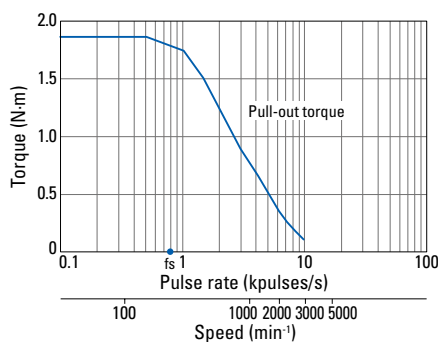
## Unipolar, lead-type, CE/UL models

| Model no.          |                    | Holding torque<br>at 2-phase excitation | Rated<br>current | Winding<br>resistance | Winding inductance | Rotor<br>inertia                    | Mass | Motor<br>length (L) |
|--------------------|--------------------|-----------------------------------------|------------------|-----------------------|--------------------|-------------------------------------|------|---------------------|
| Single shaft       | Dual shaft         | N·m or more                             | A/phase          | Ω/phase               | mH/phase           | ×10 <sup>-4</sup> kg·m <sup>2</sup> | kg   | mm                  |
| <b>SM2861-0451</b> | <b>SM2861-0421</b> | 2.5                                     | 2                | 2.3                   | 8.0                | 1.48                                | 1.75 | 66                  |
| <b>SM2861-0951</b> | <b>SM2861-0921</b> | 2.5                                     | 4                | 0.6                   | 2.0                | 1.48                                | 1.75 | 66                  |
| <b>SM2862-0451</b> | <b>SM2862-0421</b> | 4.7                                     | 2                | 3.2                   | 13.0               | 3.0                                 | 2.9  | 96.5                |
| <b>SM2862-0951</b> | <b>SM2862-0921</b> | 4.7                                     | 4                | 0.85                  | 3.4                | 3.0                                 | 2.9  | 96.5                |
| <b>SM2863-0451</b> | <b>SM2863-0421</b> | 6.7                                     | 2                | 4.0                   | 17.0               | 4.5                                 | 4.0  | 127                 |
| <b>SM2863-0951</b> | <b>SM2863-0921</b> | 6.7                                     | 4                | 0.9                   | 4.2                | 4.5                                 | 4.0  | 127                 |

## Characteristics

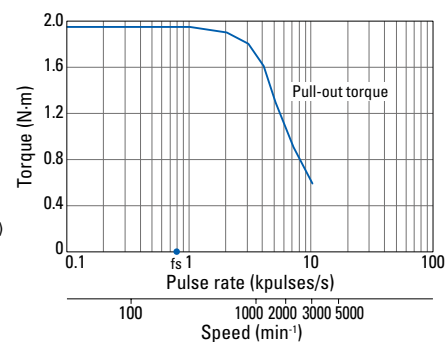
### SM2861-0451 SM2861-0421

Constant current circuit  
Input voltage: 100 VAC  
Winding current:  
2 A/phase  
At 2-phase excitation (full  
step)  
Pull-out torque:  
 $J_L = 7.4 \times 10^{-4} \text{kg} \cdot \text{m}^2$   
(with rubber coupling used)  
fs: Maximum starting pulse  
rate with no load



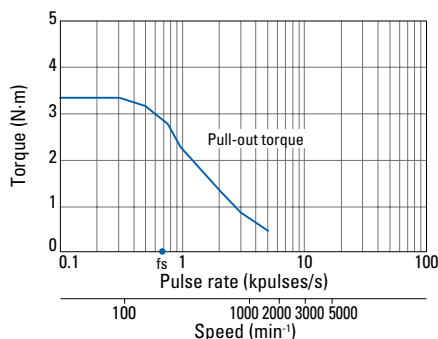
### SM2861-0951 SM2861-0921

Constant current circuit  
Input voltage: 100 VAC  
Winding current:  
4 A/phase  
At 2-phase excitation (full  
step)  
Pull-out torque:  
 $J_L = 7.4 \times 10^{-4} \text{kg} \cdot \text{m}^2$   
(with rubber coupling used)  
fs: Maximum starting pulse  
rate with no load



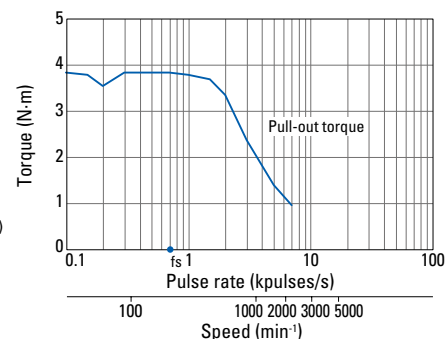
### SM2862-0451 SM2862-0421

Constant current circuit  
Input voltage: 100 VAC  
Winding current:  
2 A/phase  
At 2-phase excitation (full  
step)  
Pull-out torque:  
 $J_L = 15.3 \times 10^{-4} \text{kg} \cdot \text{m}^2$   
(with rubber coupling used)  
fs: Maximum starting pulse  
rate with no load



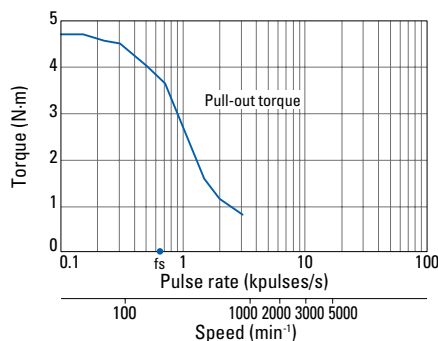
### SM2862-0951 SM2862-0921

Constant current circuit  
Input voltage: 100 VAC  
Winding current:  
4 A/phase  
At 2-phase excitation (full  
step)  
Pull-out torque:  
 $J_L = 15.3 \times 10^{-4} \text{kg} \cdot \text{m}^2$   
(with rubber coupling used)  
fs: Maximum starting pulse  
rate with no load



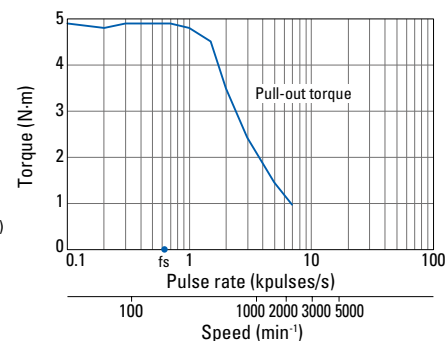
### SM2863-0451 SM2863-0421

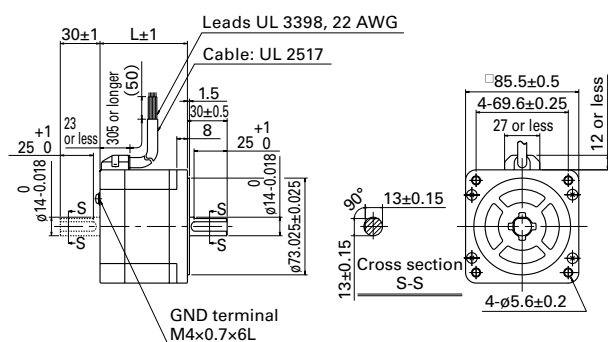
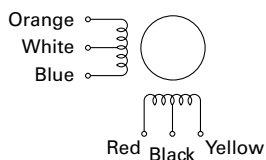
Constant current circuit  
Input voltage: 100 VAC  
Winding current:  
2 A/phase  
At 2-phase excitation (full  
step)  
Pull-out torque:  
 $J_L = 15.3 \times 10^{-4} \text{kg} \cdot \text{m}^2$   
(with rubber coupling used)  
fs: Maximum starting pulse  
rate with no load



### SM2863-0951 SM2863-0921

Constant current circuit  
Input voltage: 100 VAC  
Winding current:  
4 A/phase  
At 2-phase excitation (full  
step)  
Pull-out torque:  
 $J_L = 15.3 \times 10^{-4} \text{kg} \cdot \text{m}^2$   
(with rubber coupling used)  
fs: Maximum starting pulse  
rate with no load



**Dimensions** (Unit: mm)**Internal winding****Compatible drivers**

A driver is to be provided by the customer.



# 86 mm sq.

1.8°/step **RoHS**

Bipolar, lead-type, CE/UL models

Bipolar, terminal block-type, CE/UL models

Unipolar, lead-type, CE/UL models ▶ p. 64



**Custom options**

Hollow shaft Custom shaft

Encoder

Note: Customization feasibility depends on the model number and quantity. Contact us for details.

## Bipolar, lead-type, CE/UL models

| Model no.          |                    | Holding torque at 2-phase excitation | Rated current | Winding resistance | Winding inductance | Rotor inertia                       | Mass | Motor length (L) |
|--------------------|--------------------|--------------------------------------|---------------|--------------------|--------------------|-------------------------------------|------|------------------|
| Single shaft       | Dual shaft         | N·m or more                          | A/phase       | Ω/phase            | mH/phase           | ×10 <sup>-4</sup> kg·m <sup>2</sup> | kg   | mm               |
| <b>SM2861-5051</b> | <b>SM2861-5021</b> | 3.3                                  | 2             | 2.2                | 15                 | 1.48                                | 1.75 | 66               |
| <b>SM2861-5151</b> | <b>SM2861-5121</b> | 3.3                                  | 4             | 0.56               | 3.7                | 1.48                                | 1.75 | 66               |
| <b>SM2861-5251</b> | <b>SM2861-5221</b> | 3.3                                  | 6             | 0.29               | 1.7                | 1.48                                | 1.75 | 66               |
| <b>SM2862-5051</b> | <b>SM2862-5021</b> | 6.4                                  | 2             | 3.2                | 25                 | 3.0                                 | 2.9  | 96.5             |
| <b>SM2862-5151</b> | <b>SM2862-5121</b> | 6.4                                  | 4             | 0.83               | 6.4                | 3.0                                 | 2.9  | 96.5             |
| <b>SM2862-5251</b> | <b>SM2862-5221</b> | 6.4                                  | 6             | 0.36               | 2.8                | 3.0                                 | 2.9  | 96.5             |
| <b>SM2863-5051</b> | <b>SM2863-5021</b> | 9                                    | 2             | 4.0                | 32                 | 4.5                                 | 4.0  | 127              |
| <b>SM2863-5151</b> | <b>SM2863-5121</b> | 9                                    | 4             | 1.0                | 7.9                | 4.5                                 | 4.0  | 127              |
| <b>SM2863-5251</b> | <b>SM2863-5221</b> | 9                                    | 6             | 0.46               | 3.8                | 4.5                                 | 4.0  | 127              |

## Bipolar, terminal block-type, CE/UL models

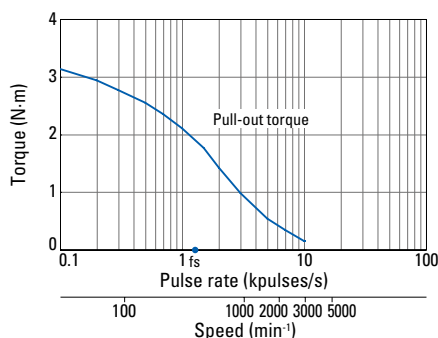
| Model no.          |  | Holding torque at 2-phase excitation | Rated current | Winding resistance | Winding inductance | Rotor inertia                       | Mass | Motor length (L) |
|--------------------|--|--------------------------------------|---------------|--------------------|--------------------|-------------------------------------|------|------------------|
| Single shaft       |  | N·m or more                          | A/phase       | Ω/phase            | mH/phase           | ×10 <sup>-4</sup> kg·m <sup>2</sup> | kg   | mm               |
| <b>SM2861-5066</b> |  | 3.3                                  | 2             | 2.03               | 15                 | 1.48                                | 1.9  | 97.9             |
| <b>SM2861-5166</b> |  | 3.3                                  | 4             | 0.52               | 3.7                | 1.48                                | 1.9  | 97.9             |
| <b>SM2861-5266</b> |  | 3.3                                  | 6             | 0.27               | 1.7                | 1.48                                | 1.9  | 97.9             |
| <b>SM2862-5066</b> |  | 6.4                                  | 2             | 3.08               | 25                 | 3.0                                 | 3.05 | 128.4            |
| <b>SM2862-5166</b> |  | 6.4                                  | 4             | 0.79               | 6.4                | 3.0                                 | 3.05 | 128.4            |
| <b>SM2862-5266</b> |  | 6.4                                  | 6             | 0.33               | 2.8                | 3.0                                 | 3.05 | 128.4            |
| <b>SM2863-5066</b> |  | 9                                    | 2             | 3.83               | 32                 | 4.5                                 | 4.15 | 158.8            |
| <b>SM2863-5166</b> |  | 9                                    | 4             | 0.96               | 7.9                | 4.5                                 | 4.15 | 158.8            |
| <b>SM2863-5266</b> |  | 9                                    | 6             | 0.48               | 3.8                | 4.5                                 | 4.15 | 158.8            |

## Characteristics

### SM2861-5051 SM2861-5021

### SM2861-5066

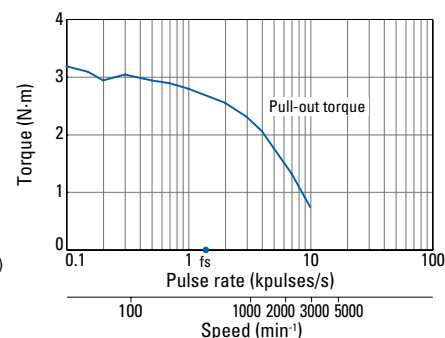
Constant current circuit  
Input voltage: 100 VAC  
Winding current:  
2 A/phase  
At 2-phase excitation (full step)  
Pull-out torque:  
 $J_L = 15.3 \times 10^{-4} \text{kg} \cdot \text{m}^2$   
(with rubber coupling used)  
fs: Maximum starting pulse rate with no load



### SM2861-5151 SM2861-5121

### SM2861-5166

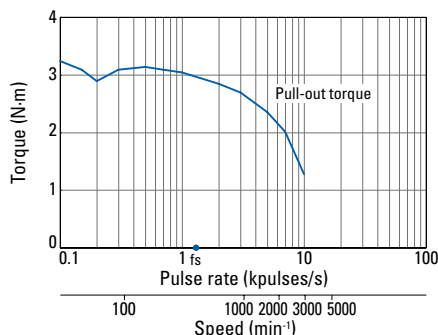
Constant current circuit  
Input voltage: 100 VAC  
Winding current:  
4 A/phase  
At 2-phase excitation (full step)  
Pull-out torque:  
 $J_L = 15.3 \times 10^{-4} \text{kg} \cdot \text{m}^2$   
(with rubber coupling used)  
fs: Maximum starting pulse rate with no load



### SM2861-5251 SM2861-5221

### SM2861-5266

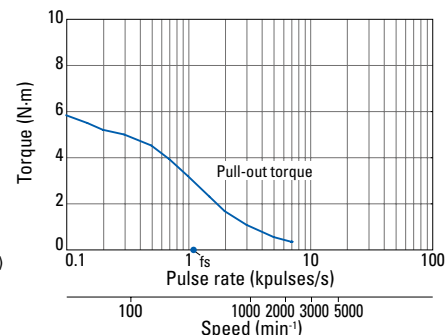
Constant current circuit  
Input voltage: 100 VAC  
Winding current:  
6 A/phase  
At 2-phase excitation (full step)  
Pull-out torque:  
 $J_L = 15.3 \times 10^{-4} \text{kg} \cdot \text{m}^2$   
(with rubber coupling used)  
fs: Maximum starting pulse rate with no load



### SM2862-5051 SM2862-5021

### SM2862-5066

Constant current circuit  
Input voltage: 100 VAC  
Winding current:  
2 A/phase  
At 2-phase excitation (full step)  
Pull-out torque:  
 $J_L = 15.3 \times 10^{-4} \text{kg} \cdot \text{m}^2$   
(with rubber coupling used)  
fs: Maximum starting pulse rate with no load

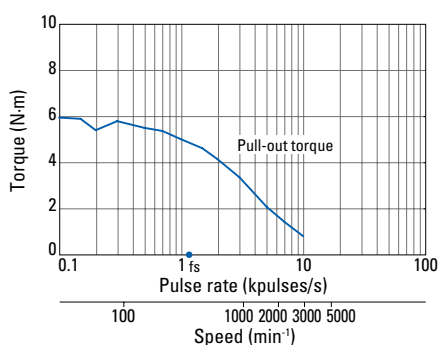


## Characteristics

**SM2862-5151**  
**SM2862-5121**

## SM2862-5166

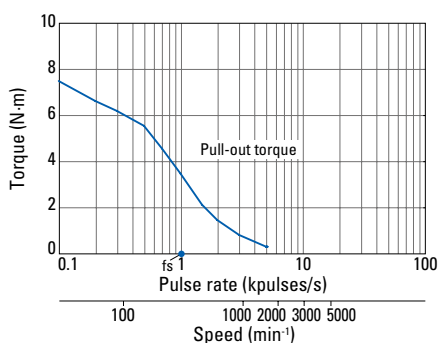
Constant current circuit  
Input voltage: 100 VAC  
Winding current:  
4 A/phase  
At 2-phase excitation (full  
step)  
Pull-out torque:  
 $J_L = 15.3 \times 10^{-4} \text{ kg} \cdot \text{m}^2$   
(with rubber coupling used)  
fs: Maximum starting pulse  
rate with no load



**SM2863-5051**  
**SM2863-5021**

## SM2863-5066

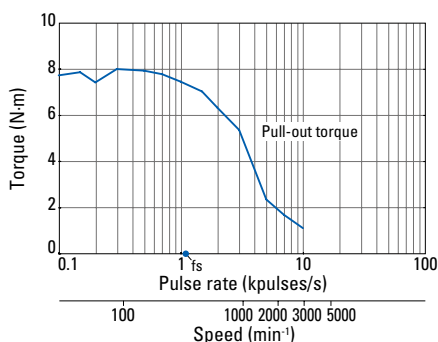
Constant current circuit  
Input voltage: 100 VAC  
Winding current:  
2 A/phase  
At 2-phase excitation (full  
step)  
Pull-out torque:  
 $J_L = 44 \times 10^{-4} \text{ kg} \cdot \text{m}^2$   
(with rubber coupling used)  
f<sub>s</sub>: Maximum starting pulse  
rate with no load



**SM2863-5251**  
**SM2863-5221**

## SM2863-5266

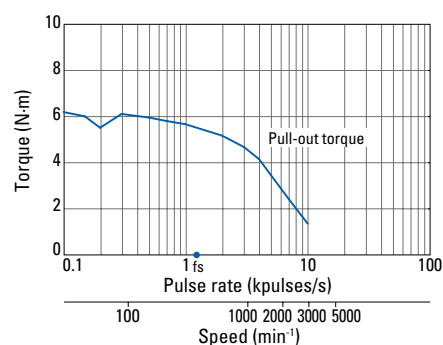
Constant current circuit  
Input voltage: 100 VAC  
Winding current:  
6 A/phase  
At 2-phase excitation (full  
step)  
Pull-out torque:  
 $J_L = 44 \times 10^{-4} \text{ kg} \cdot \text{m}^2$   
(with rubber coupling used)  
fs: Maximum starting pulse  
rate with no load



SM2862-5251  
SM2862-5221

## SM2862-5066

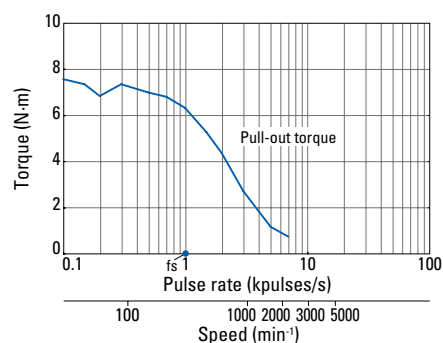
Constant current circuit  
Input voltage: 100 VAC  
Winding current:  
6 A/phase  
At 2-phase excitation (full  
step)  
Pull-out torque:  
 $J_L = 15.3 \times 10^{-2} \text{ kg} \cdot \text{m}^2$   
(with rubber coupling used)  
fs: Maximum starting pulse  
rate with no load



SM2863-5151  
SM2863-5121

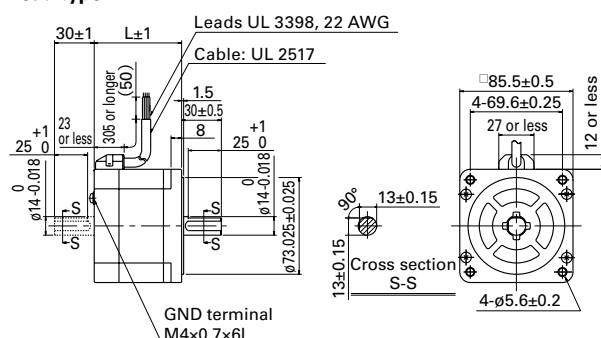
## SM2863-5166

Constant current circuit  
Input voltage: 100 VAC  
Winding current:  
4 A/phase  
At 2-phase excitation (full  
step)  
Pull-out torque:  
 $J_L = 44 \times 10^{-2} \text{ kg} \cdot \text{m}^2$   
(with rubber coupling used)  
fs: Maximum starting pulse  
rate with no load

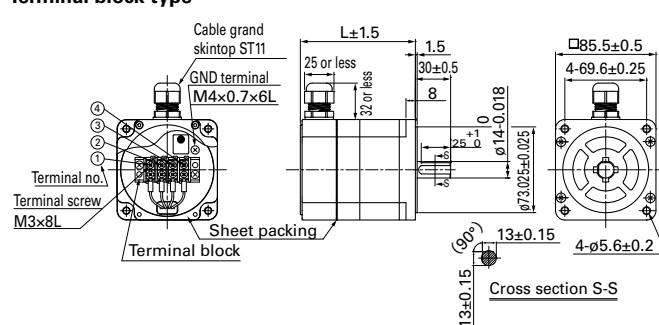


### Dimensions (Unit: mm)

### Lead type

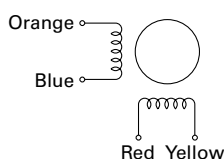


### Terminal block type



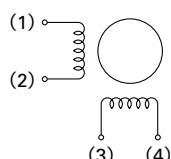
## Internal winding

### Lead type



### Terminal block type

Inside parentheses are terminal numbers



## Compatible drivers

A driver is to be provided by the customer.



**Ø106 mm**

1.8°/step **RoHS**

Bipolar, lead type, CE models



## Custom options

Hollow shaft Custom shaft

**Note:** Customization feasibility depends on the model number and quantity. Contact us for details.

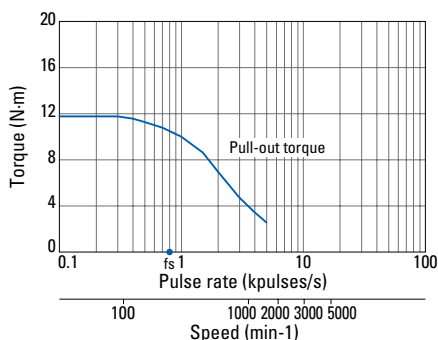
### Bipolar, lead type, CE models

| Model no.             |                       | Holding torque<br>at 2-phase excitation | Rated<br>current | Winding<br>resistance | Winding inductance | Rotor<br>inertia                    | Mass | Motor<br>length (L) |
|-----------------------|-----------------------|-----------------------------------------|------------------|-----------------------|--------------------|-------------------------------------|------|---------------------|
| Single shaft          | Dual shaft            | N·m or more                             | A/phase          | Ω/phase               | mH/phase           | ×10 <sup>4</sup> ·kg·m <sup>2</sup> | kg   | mm                  |
| <b>103H89222-6341</b> | <b>103H89222-6311</b> | 13.2                                    | 6                | 0.45                  | 5.4                | 14.6                                | 7.5  | 163.3               |
| <b>103H89223-6341</b> | <b>103H89223-6311</b> | 19                                      | 6                | 0.63                  | 8                  | 22                                  | 10.5 | 221.3               |

## Characteristics

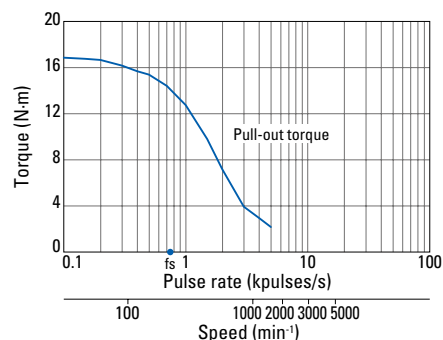
103H89222-6341  
103H89222-6311

Constant current circuit  
Input voltage: 100 VAC  
Winding current:  
6 A/phase  
At 2-phase excitation (full  
step)  
Pull-out torque:  
 $J_L = 44 \times 10^{-4} \text{ kg}\cdot\text{m}^2$   
(with rubber coupling used)  
fs: Maximum starting pulse  
rate with no load

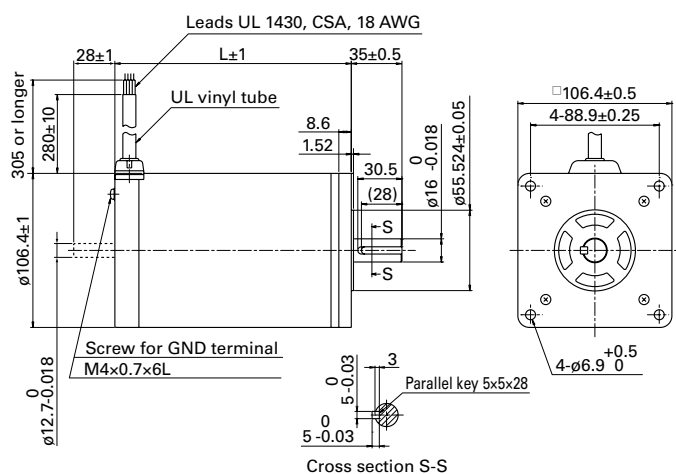


103H89223-6341  
103H89223-6311

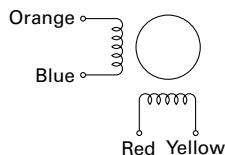
Constant current circuit  
Input voltage: 100 VAC  
Winding current:  
6 A/phase  
At 2-phase excitation (full  
step)  
Pull-out torque:  
 $J_L = 44 \times 10^{-4} \text{ kg} \cdot \text{m}^2$   
(with rubber coupling used)  
fs: Maximum starting pulse  
rate with no load



### ■ Dimensions (Unit: mm)



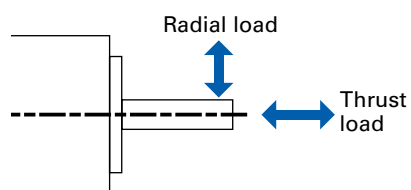
## Internal winding



## Compatible drivers

A driver is to be provided by the customer.

# Allowable Radial and Thrust Loads



| Motor size       | Model no.        | Distance from shaft end (mm) |     |     |     | Thrust load (N) |
|------------------|------------------|------------------------------|-----|-----|-----|-----------------|
|                  |                  | 0                            | 5   | 10  | 15  |                 |
|                  |                  | Radial load (N)              |     |     |     |                 |
| <b>14 mm sq.</b> | SH214 □          | 10                           | 10  | 10  | —   | 0.7             |
| <b>28 mm sq.</b> | SH2281           | 42                           | 42  | 42  | —   | 3               |
|                  | SH2285           | 49                           | 49  | 49  | —   |                 |
| <b>35 mm sq.</b> | SH35 □ □         | 40                           | 51  | 67  | 90  | 10              |
| <b>42 mm sq.</b> | SF242 □          | 20                           | 29  | 47  | 64  | 10              |
|                  | SH142 □          | 20                           | 25  | 32  | 37  |                 |
|                  | SS242 □ -50 □ 1  | 10                           | —   | —   | —   | 4.9             |
|                  | SS242 □ -50 □ 00 | 25                           | 25  | —   | —   |                 |
| <b>50 mm sq.</b> | 103H670 □        | 74                           | 91  | 120 | 174 | 15              |
|                  | SS250 □          | 8.5                          | —   | —   | —   | 4.9             |
| <b>56 mm sq.</b> | SM256 □          | 70                           | 87  | 114 | 166 | 20              |
| <b>60 mm sq.</b> | SH160 □          | 65                           | 86  | 129 | 210 | 15              |
|                  | SH1603           | 83                           | 103 | 135 | 197 |                 |
| <b>86 mm sq.</b> | SM286 □          | 200                          | 200 | 200 | 200 | 60              |
|                  | SH286 □          |                              |     |     |     |                 |
| <b>φ106 mm</b>   | 103H8922 □       | 321                          | 356 | 400 | 457 | 100             |



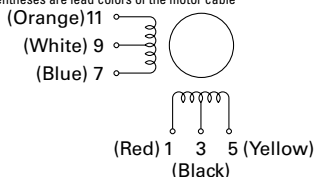
# Internal Wiring and Rotational Directions

## Unipolar winding

Connector type, model no.: SF242 ☐

### Internal wiring

In parentheses are lead colors of the motor cable



### Direction of motor rotation

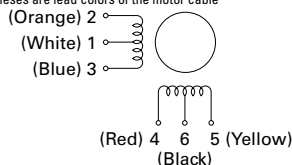
When excited by a direct current in the order shown below, the direction of rotation is clockwise as viewed from the output shaft side.

|                     |   | Connector pin no. |   |   |   |    |
|---------------------|---|-------------------|---|---|---|----|
|                     |   | 3, 9              | 1 | 7 | 5 | 11 |
| Excitation sequence | 1 | +                 | — | — | — | —  |
|                     | 2 | +                 | — | — | — | —  |
|                     | 3 | +                 | — | — | — | —  |
|                     | 4 | +                 | — | — | — | —  |

Connector type, model no.: SM256 ☐ (and 103H782 ☐)

### Internal wiring

In parentheses are lead colors of the motor cable



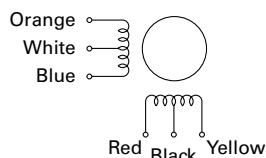
### Direction of motor rotation

When excited by a direct current in the order shown below, the direction of rotation is clockwise as viewed from the output shaft side.

|                     |   | Connector pin no. |   |   |   |   |
|---------------------|---|-------------------|---|---|---|---|
|                     |   | 1, 6              | 4 | 3 | 5 | 2 |
| Excitation sequence | 1 | +                 | — | — | — | — |
|                     | 2 | +                 | — | — | — | — |
|                     | 3 | +                 | — | — | — | — |
|                     | 4 | +                 | — | — | — | — |

Lead type

### Internal wiring



### Direction of motor rotation

When excited by a direct current in the order shown below, the direction of rotation is clockwise as viewed from the output shaft side.

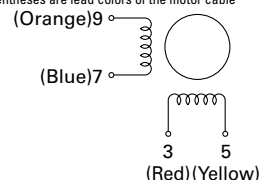
|                     |   | Lead color   |     |      |        |        |
|---------------------|---|--------------|-----|------|--------|--------|
|                     |   | White, Black | Red | Blue | Yellow | Orange |
| Excitation sequence | 1 | +            | —   | —    | —      | —      |
|                     | 2 | +            | —   | —    | —      | —      |
|                     | 3 | +            | —   | —    | —      | —      |
|                     | 4 | +            | —   | —    | —      | —      |

## Bipolar winding

Connector type, model no.: SF242 ☐

### Internal wiring

In parentheses are lead colors of the motor cable



### Direction of motor rotation

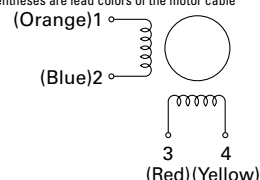
When excited by a direct current in the order shown below, the direction of rotation is clockwise as viewed from the output shaft side.

|                     |   | Connector pin no. |   |   |   |
|---------------------|---|-------------------|---|---|---|
|                     |   | 3                 | 7 | 5 | 9 |
| Excitation sequence | 1 | —                 | — | + | + |
|                     | 2 | +                 | — | — | + |
|                     | 3 | +                 | + | — | — |
|                     | 4 | —                 | + | + | — |

Connector type, model no.: SM256 ☐ (and 103H782 ☐)

### Internal wiring

In parentheses are lead colors of the motor cable



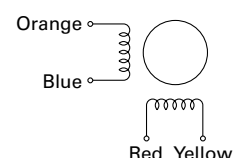
### Direction of motor rotation

When excited by a direct current in the order shown below, the direction of rotation is clockwise as viewed from the output shaft side.

|                     |   | Connector pin no. |   |   |   |
|---------------------|---|-------------------|---|---|---|
|                     |   | 3                 | 2 | 4 | 1 |
| Excitation sequence | 1 | —                 | — | + | + |
|                     | 2 | +                 | — | — | + |
|                     | 3 | +                 | + | — | — |
|                     | 4 | —                 | + | + | — |

Lead type

### Internal wiring



### Direction of motor rotation

When excited by a direct current in the order shown below, the direction of rotation is clockwise as viewed from the output shaft side.

|                     |   | Lead color |      |        |        |
|---------------------|---|------------|------|--------|--------|
|                     |   | Red        | Blue | Yellow | Orange |
| Excitation sequence | 1 | —          | —    | +      | +      |
|                     | 2 | +          | —    | —      | +      |
|                     | 3 | +          | +    | —      | —      |
|                     | 4 | —          | +    | +      | —      |

# General Specifications

|                                                      |                                                                                                                                                                                                                             |                                         |                                       |                                       |                                       |                                |                                       |                                                                                                                                                       |
|------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------|---------------------------------------|---------------------------------------|---------------------------------------|--------------------------------|---------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------|
| Motor model no.                                      | SH214 <input type="checkbox"/>                                                                                                                                                                                              | SH228 <input type="checkbox"/>          | SH353 <input type="checkbox"/>        | SS242 <input type="checkbox"/>        | SH142 <input type="checkbox"/>        | SF242 <input type="checkbox"/> | SS250 <input type="checkbox"/>        | 103H670 <input type="checkbox"/>                                                                                                                      |
| Operation type                                       | —                                                                                                                                                                                                                           |                                         |                                       |                                       |                                       |                                |                                       |                                                                                                                                                       |
| Operating ambient temperature                        | -10 to +50°C                                                                                                                                                                                                                |                                         |                                       |                                       |                                       |                                |                                       |                                                                                                                                                       |
| Storage temperature                                  | -20 to +65°C                                                                                                                                                                                                                |                                         |                                       |                                       |                                       |                                |                                       |                                                                                                                                                       |
| Operating ambient humidity                           | 20 to 90% RH (non-condensing)                                                                                                                                                                                               |                                         |                                       |                                       |                                       |                                |                                       |                                                                                                                                                       |
| Storage humidity                                     | 5 to 95 % RH (non-condensing)                                                                                                                                                                                               |                                         |                                       |                                       |                                       |                                |                                       |                                                                                                                                                       |
| Operating altitude                                   | Up to 1000 m above sea level                                                                                                                                                                                                |                                         |                                       |                                       |                                       |                                |                                       |                                                                                                                                                       |
| Vibration resistance                                 | Frequency 10 to 500 Hz, amplitude 1.52 mm (10 to 70 Hz), vibration acceleration 150 m/s <sup>2</sup> (70 to 500 Hz), sweep time 15 min/cycle, a total of 12 tests in both opposite directions for each of X, Y, and Z axes. |                                         |                                       |                                       |                                       |                                |                                       |                                                                                                                                                       |
| Shock resistance                                     | Acceleration 500 m/s <sup>2</sup> , duration 11 ms, half sine wave, tested 3 times in both directions for each X, Y, and Z axis for a total of 18 times                                                                     |                                         |                                       |                                       |                                       |                                |                                       |                                                                                                                                                       |
| Thermal class                                        | B (+130°C)                                                                                                                                                                                                                  |                                         |                                       |                                       |                                       |                                |                                       |                                                                                                                                                       |
| Dielectric strength                                  | No abnormality after application of 500 VAC at 50/60 Hz between the motor winding and motor frame for one minute at normal temperature and humidity.                                                                        |                                         |                                       |                                       |                                       |                                |                                       | No abnormality after application of 1000 VAC at 50/60 Hz between the motor winding and motor frame for one minute at normal temperature and humidity. |
| Insulation resistance                                | 100 MΩ or more with a 500 VDC megger between the motor winding and motor frame at normal temperature and humidity.                                                                                                          |                                         |                                       |                                       |                                       |                                |                                       |                                                                                                                                                       |
| Protection rating                                    | —                                                                                                                                                                                                                           |                                         |                                       |                                       |                                       |                                |                                       |                                                                                                                                                       |
| Winding temperature rise                             | 80 K or less (based on our own standard)                                                                                                                                                                                    |                                         |                                       |                                       |                                       |                                |                                       |                                                                                                                                                       |
| Positional accuracy                                  | ±0.09°                                                                                                                                                                                                                      |                                         |                                       |                                       | ±0.054°                               |                                | ±0.09°                                |                                                                                                                                                       |
| Thrust play <sup>(1)</sup>                           | 0.075 mm or less<br>(With a 0.35 N load)                                                                                                                                                                                    | 0.075 mm or less<br>(With a 1.5 N load) | 0.075 mm or less<br>(With a 5 N load) | 0.075 mm or less<br>(With a 4 N load) | 0.075 mm or less<br>(With a 5 N load) | 0.075 mm<br>(With a 5 N load)  | 0.075 mm or less<br>(With a 4 N load) | 0.075 mm<br>(With a 10 N load)                                                                                                                        |
| Radial play <sup>(2)</sup>                           | 0.025 mm (With a 5 N load)                                                                                                                                                                                                  |                                         |                                       |                                       |                                       |                                |                                       |                                                                                                                                                       |
| Shaft runout                                         | 0.025 mm                                                                                                                                                                                                                    |                                         |                                       |                                       |                                       |                                |                                       |                                                                                                                                                       |
| Concentricity of motor shaft and fitting part        | ø0.05 mm                                                                                                                                                                                                                    | ø0.05 mm                                | ø0.075 mm                             | ø0.075 mm                             | ø0.05 mm                              | ø0.05 mm                       | ø0.075 mm                             | ø0.075 mm                                                                                                                                             |
| Perpendicularity of mounting surface and motor shaft | 0.1 mm                                                                                                                                                                                                                      | 0.1 mm                                  | 0.1 mm                                | 0.1 mm                                | 0.1 mm                                | 0.1 mm                         | 0.1 mm                                | 0.1 mm                                                                                                                                                |
| Motor mounting orientation                           | Can be installed vertically or horizontally.                                                                                                                                                                                |                                         |                                       |                                       |                                       |                                |                                       |                                                                                                                                                       |

|                                                      |                                                                                                                                                                                                                             |                                                                                                                                                       |                                |                                                                                                                                                       |                                                                                                            |                                                                                           |                                                                                             |
|------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------|
| Motor model no.                                      | SM256 <input type="checkbox"/><br>UL models                                                                                                                                                                                 | SH160 <input type="checkbox"/>                                                                                                                        | SH286 <input type="checkbox"/> | 103H8922 <input type="checkbox"/>                                                                                                                     | SM286 <input type="checkbox"/><br>CE/UL models                                                             | 103H712 <input type="checkbox"/> -6 <input type="checkbox"/> 0 <input type="checkbox"/> 0 | 103H8922 <input type="checkbox"/> -63 <input type="checkbox"/> 1 <input type="checkbox"/> 1 |
| Operation type                                       | -                                                                                                                                                                                                                           |                                                                                                                                                       |                                |                                                                                                                                                       | Continuous operation (S1)                                                                                  |                                                                                           |                                                                                             |
| Operating ambient temperature                        | -10 to +50°C                                                                                                                                                                                                                |                                                                                                                                                       |                                |                                                                                                                                                       | -10 to +40°C                                                                                               |                                                                                           |                                                                                             |
| Storage temperature                                  | -20 to +65°C                                                                                                                                                                                                                |                                                                                                                                                       |                                |                                                                                                                                                       | -20 to +60°C                                                                                               |                                                                                           |                                                                                             |
| Operating ambient humidity                           | 20 to 90% RH (non-condensing)                                                                                                                                                                                               |                                                                                                                                                       |                                |                                                                                                                                                       | 95% RH or less: Below 40°C (non-condensing)                                                                |                                                                                           |                                                                                             |
| Storage humidity                                     | 5 to 95 % RH (non-condensing)                                                                                                                                                                                               |                                                                                                                                                       |                                |                                                                                                                                                       | 95% RH or less: Below 40°C,<br>57% RH or less: Below 50°C,<br>35% RH or less: Below 60°C, (non-condensing) |                                                                                           |                                                                                             |
| Operating altitude                                   | Up to 1000 m above sea level                                                                                                                                                                                                |                                                                                                                                                       |                                |                                                                                                                                                       |                                                                                                            |                                                                                           |                                                                                             |
| Vibration resistance                                 | Frequency 10 to 500 Hz, amplitude 1.52 mm (10 to 70 Hz), vibration acceleration 150 m/s <sup>2</sup> (70 to 500 Hz), sweep time 15 min/cycle, a total of 12 tests in both opposite directions for each of X, Y, and Z axes. |                                                                                                                                                       |                                |                                                                                                                                                       |                                                                                                            |                                                                                           |                                                                                             |
| Shock resistance                                     | Acceleration 500 m/s <sup>2</sup> , duration 11 ms, half sine wave, tested 3 times in both directions for each X, Y, and Z axis for a total of 18 times                                                                     |                                                                                                                                                       |                                |                                                                                                                                                       |                                                                                                            |                                                                                           |                                                                                             |
| Thermal class                                        | B (+130°C) (A for UL models)                                                                                                                                                                                                |                                                                                                                                                       | B (+130°C)                     |                                                                                                                                                       | F (+155°C)                                                                                                 |                                                                                           | B (+130°C)                                                                                  |
| Dielectric strength                                  | No abnormality after application of 1120 VAC at 50/60 Hz between the motor winding and motor frame for one minute at normal temperature and humidity.                                                                       | No abnormality after application of 1000 VAC at 50/60 Hz between the motor winding and motor frame for one minute at normal temperature and humidity. |                                | No abnormality after application of 1500 VAC at 50/60 Hz between the motor winding and motor frame for one minute at normal temperature and humidity. |                                                                                                            |                                                                                           |                                                                                             |
| Insulation resistance                                | 100 MΩ or more with a 500 VDC megger between the motor winding and motor frame at normal temperature and humidity.                                                                                                          |                                                                                                                                                       |                                |                                                                                                                                                       |                                                                                                            |                                                                                           |                                                                                             |
| Protection rating                                    | -                                                                                                                                                                                                                           |                                                                                                                                                       |                                |                                                                                                                                                       | IP43                                                                                                       |                                                                                           |                                                                                             |
| Winding temperature rise                             | 80 K or less (based on our own standard)                                                                                                                                                                                    |                                                                                                                                                       |                                |                                                                                                                                                       |                                                                                                            |                                                                                           |                                                                                             |
| Positional accuracy tolerance                        | ±0.054°                                                                                                                                                                                                                     |                                                                                                                                                       |                                | ±0.09°                                                                                                                                                |                                                                                                            | ±0.054°                                                                                   | ±0.09°                                                                                      |
| Thrust play <sup>(1)</sup>                           | 0.075 mm (With a 10 N load)                                                                                                                                                                                                 |                                                                                                                                                       |                                |                                                                                                                                                       |                                                                                                            |                                                                                           |                                                                                             |
| Radial play <sup>(2)</sup>                           | 0.025 mm (With a 5 N load)                                                                                                                                                                                                  | 0.025 mm<br>(With a 5 N load)                                                                                                                         | 0.025 mm<br>(With a 5 N load)  | 0.025 mm<br>(With a 10 N load)                                                                                                                        | 0.025 mm<br>(With a 5 N load)                                                                              | 0.025 mm<br>(With a 5 N load)                                                             | 0.025 mm<br>(With a 10 N load)                                                              |
| Runout of shaft                                      | 0.025 mm                                                                                                                                                                                                                    |                                                                                                                                                       |                                |                                                                                                                                                       |                                                                                                            |                                                                                           |                                                                                             |
| Concentricity of motor shaft and fitting part        | ø0.075 mm                                                                                                                                                                                                                   |                                                                                                                                                       |                                |                                                                                                                                                       |                                                                                                            |                                                                                           |                                                                                             |
| Perpendicularity of mounting surface and motor shaft | 0.1 mm                                                                                                                                                                                                                      | 0.1 mm                                                                                                                                                | 0.15 mm                        | 0.1 mm                                                                                                                                                | 0.15 mm                                                                                                    | 0.1 mm                                                                                    | 0.1 mm                                                                                      |
| Motor mounting orientation                           | Can be installed vertically or horizontally.                                                                                                                                                                                |                                                                                                                                                       |                                |                                                                                                                                                       |                                                                                                            |                                                                                           |                                                                                             |

(1) Thrust play: Maximum shaft position displacement when a load is exerted in a direction parallel to the motor shaft.

(2) Radial play: Maximum shaft position displacement when a load is exerted in a direction perpendicular to the motor shaft.

## Safety standards

Model no.: SM256 ☐ UL models

| UL | Classification      | Standards            | File no. |
|----|---------------------|----------------------|----------|
| UL | UL                  | UL 1004-1, UL 1004-6 | E179832  |
|    | UL for Canada (cUL) | CSA C22.2 No. 100    |          |

Model no.: 103H712 ☐ -6 ☐ 0 ☐ 0, 103H8922 ☐ -63 ☐ 1 CE models

| CE (TÜV) | Directive             | Standards              |
|----------|-----------------------|------------------------|
| CE (TÜV) | Low Voltage Directive | EN 60034-1, EN 60034-5 |
|          |                       |                        |

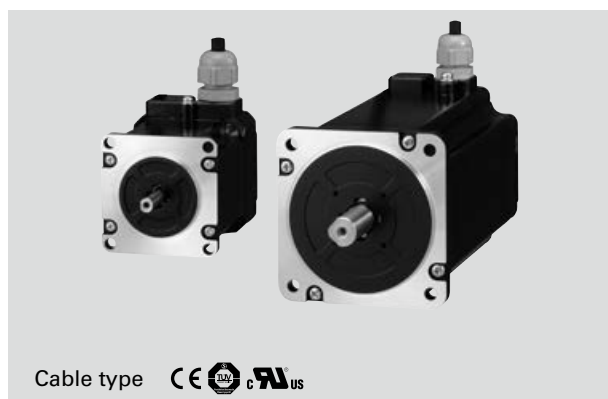
Model no.: SM286 ☐ CE/UL models

| CE (TÜV) | Directive             | Standards              |
|----------|-----------------------|------------------------|
| CE (TÜV) | Low Voltage Directive | EN 60034-1, EN 60034-5 |
|          |                       |                        |

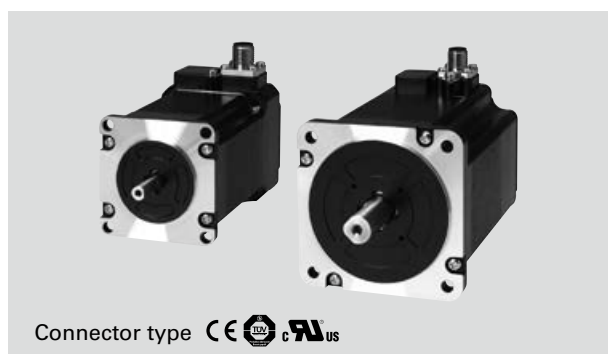
| UL | Classification      | Standards            | File no. |
|----|---------------------|----------------------|----------|
| UL | UL                  | UL 1004-1, UL 1004-6 | E179832  |
|    | UL for Canada (cUL) | CSA C22.2 No. 100    |          |

# IP65-Rated Stepping Motors

Water and dust protection



Cable type CE c UL US



Connector type CE c UL US

## Features

- These IP65-rated motors\* have superior water and dust resistance, and can be safely used in water-exposed environments such as in food processing machines.

\* Except for the shaft and cable ends.

- Options such as a brake, encoder, and oil seal can be combined.

## Safety standards

- In compliant with CE/UL safety standards.

## Specifications

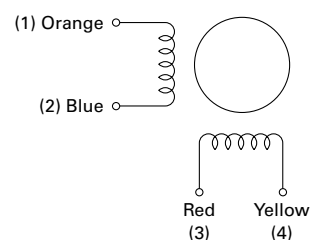
|                                                      | 56 mm sq.                                                                                                                                                                                                                   | 86 mm sq.        |
|------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------|
| Motor model no.                                      | SP256-5-0                                                                                                                                                                                                                   | SP286-5-0        |
| Operation type                                       | Continuous operation (S1)                                                                                                                                                                                                   |                  |
| Operating ambient temperature                        | -10 to +40°C                                                                                                                                                                                                                |                  |
| Storage temperature                                  | -20 to +60°C                                                                                                                                                                                                                |                  |
| Operating ambient humidity                           | 95% RH or less: Below 40°C (non-condensing)                                                                                                                                                                                 |                  |
| Storage humidity                                     | 95% RH or less: Below 40°C,<br>57% RH or less: Below 50°C,<br>35% RH or less: Below 60°C, (non-condensing)                                                                                                                  |                  |
| Operating altitude                                   | Up to 1000 m above sea level                                                                                                                                                                                                |                  |
| Vibration resistance                                 | Frequency 10 to 500 Hz, amplitude 1.52 mm (10 to 70 Hz), vibration acceleration 150 m/s <sup>2</sup> (70 to 500 Hz), sweep time 15 min/cycle, a total of 12 tests in both opposite directions for each of X, Y, and Z axes. |                  |
| Shock resistance                                     | Acceleration 500 m/s <sup>2</sup> , duration 11 ms, half sine wave, tested 3 times in both directions for each X, Y, and Z axis for a total of 18 times                                                                     |                  |
| Thermal class                                        | F (+155°C)                                                                                                                                                                                                                  |                  |
| Dielectric strength                                  | No abnormality after application of 1500 VAC at 50/60 Hz between the motor winding and motor frame for one minute at normal temperature and humidity.                                                                       |                  |
| Insulation resistance                                | 100 M $\Omega$ or more with a 500 VDC megger between the motor winding and motor frame at normal temperature and humidity.                                                                                                  |                  |
| Protection rating                                    | IP65 (excluding the hollow shaft part and cable ends)                                                                                                                                                                       |                  |
| Winding temperature rise                             | 100 K or less (based on our own standard)                                                                                                                                                                                   |                  |
| Positional accuracy tolerance                        | $\pm 0.054^\circ$                                                                                                                                                                                                           | $\pm 0.09^\circ$ |
| Thrust play                                          | 0.075 mm or less (With a 10 N load)                                                                                                                                                                                         |                  |
| Radial play                                          | 0.025 mm or less (With a 5 N load)                                                                                                                                                                                          |                  |
| Runout of shaft                                      | 0.025 mm                                                                                                                                                                                                                    |                  |
| Concentricity of motor shaft and fitting part        | $\phi 0.075$ mm                                                                                                                                                                                                             |                  |
| Perpendicularity of mounting surface and motor shaft | 0.1 mm                                                                                                                                                                                                                      | 0.15 mm          |
| Motor mounting orientation                           | Can be installed vertically or horizontally.                                                                                                                                                                                |                  |

## Internal Wiring and Rotational Directions

Bipolar winding

Internal wiring

In parentheses are connector pin nos.



## Rotating direction

When excited by a direct current in the order shown below, the direction of rotation is clockwise as viewed from the output shaft side.

| Lead color          | Red | Blue | Yellow | Orange |
|---------------------|-----|------|--------|--------|
| Connector pin no.   | 3   | 2    | 4      | 1      |
| Excitation sequence | 1   | —    | —      | +      |
|                     | 2   | +    | —      | —      |
|                     | 3   | +    | +      | —      |
|                     | 4   | —    | +      | —      |

## Safety standards

|    |                       |                        |          |
|----|-----------------------|------------------------|----------|
| CE | Directive             | Standards              |          |
|    | Low Voltage Directive | EN 60034-1, EN 60034-5 |          |
| UL | Classification        | Standards              | File no. |
|    | UL                    | UL 1004-1, UL 1004-6   | E179832  |
|    | UL for Canada (cUL)   | CSA C22.2 No. 100      |          |

Models with brake or oil seal have different model nos.

Models with an encoder have different model nos. and vibration resistance.

# 56 mm sq.

1.8°/step

RoHS

Bipolar



Custom options

Custom shaft

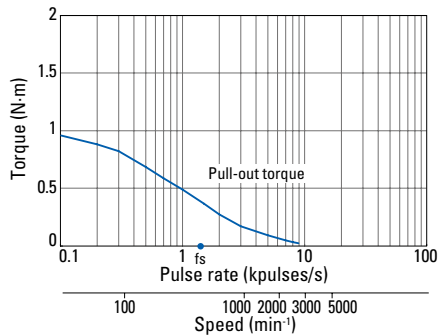
Note: Customization feasibility depends on the model number and quantity. Contact us for details.

| Model no.   |                | Holding torque<br>at 2-phase excitation | Rated<br>current | Winding<br>resistance | Winding<br>inductance | Rotor inertia                        | Mass | Allowable<br>thrust load | Allowable<br>radial load |
|-------------|----------------|-----------------------------------------|------------------|-----------------------|-----------------------|--------------------------------------|------|--------------------------|--------------------------|
| Cable type  | Connector type | N·m or more                             | A/phase          | Ω/phase               | mH/phase              | ×10 <sup>-4</sup> ·kg·m <sup>2</sup> | kg   | N                        | N                        |
| SP2563-5060 | SP2563-5000    | 1                                       | 1                | 5.8                   | 29                    | 0.21                                 | 0.9  | 15                       | 52                       |
| SP2563-5160 | SP2563-5100    | 1                                       | 2                | 1.5                   | 7.3                   | 0.21                                 | 0.9  | 15                       | 52                       |
| SP2563-5260 | SP2563-5200    | 1                                       | 3                | 0.75                  | 3.4                   | 0.21                                 | 0.9  | 15                       | 52                       |
| SP2566-5060 | SP2566-5000    | 1.7                                     | 1                | 7.8                   | 35.4                  | 0.36                                 | 1.2  | 15                       | 23                       |
| SP2566-5160 | SP2566-5100    | 1.7                                     | 2                | 2                     | 9.2                   | 0.36                                 | 1.2  | 15                       | 23                       |
| SP2566-5260 | SP2566-5200    | 1.7                                     | 3                | 1                     | 4.4                   | 0.36                                 | 1.2  | 15                       | 23                       |

• Models with a brake, encoder, or oil seal have different model nos., rotor inertia, and mass.

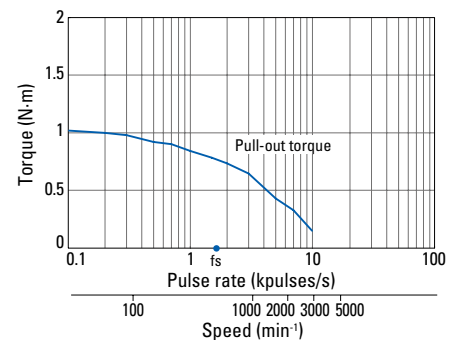
## Characteristics

SP2563-5000  
SP2563-5060



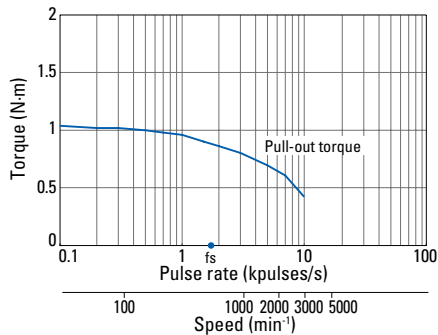
Constant current circuit  
Input voltage: 100 VAC  
Winding current: 1 A/phase, At 2-phase excitation (full step)  
Pull-out torque:  $J_L = 2.6 \times 10^{-4} \text{ kg} \cdot \text{m}^2$  (with rubber coupling used)  
fs: Maximum starting pulse rate with no load

SP2563-5100  
SP2563-5160



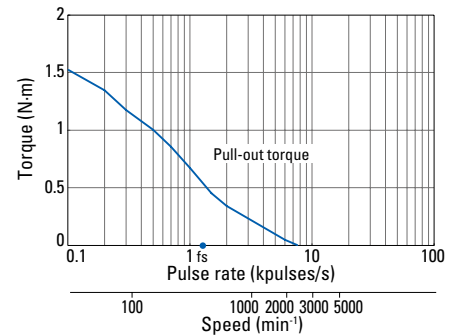
Constant current circuit  
Input voltage: 100 VAC  
Winding current: 2 A/phase, At 2-phase excitation (full step)  
Pull-out torque:  $J_L = 2.6 \times 10^{-4} \text{ kg} \cdot \text{m}^2$  (with rubber coupling used)  
fs: Maximum starting pulse rate with no load

SP2563-5200  
SP2563-5260



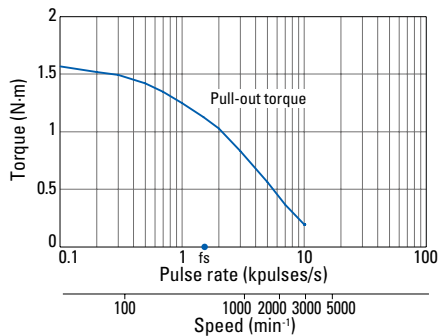
Constant current circuit  
Input voltage: 100 VAC  
Winding current: 3 A/phase, At 2-phase excitation (full step)  
Pull-out torque:  $J_L = 2.6 \times 10^{-4} \text{ kg} \cdot \text{m}^2$  (with rubber coupling used)  
fs: Maximum starting pulse rate with no load

SP2566-5000  
SP2566-5060



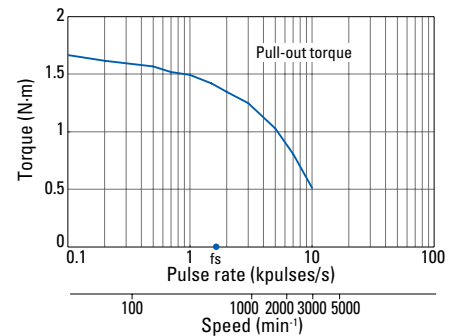
Constant current circuit  
Input voltage: 100 VAC  
Winding current: 1 A/phase, At 2-phase excitation (full step)  
Pull-out torque:  $J_L = 7.4 \times 10^{-4} \text{ kg} \cdot \text{m}^2$  (with rubber coupling used)  
fs: Maximum starting pulse rate with no load

SP2566-5100  
SP2566-5160



Constant current circuit  
Input voltage: 100 VAC  
Winding current: 2 A/phase, At 2-phase excitation (full step)  
Pull-out torque:  $J_L = 7.4 \times 10^{-4} \text{ kg} \cdot \text{m}^2$  (with rubber coupling used)  
fs: Maximum starting pulse rate with no load

SP2566-5200  
SP2566-5260

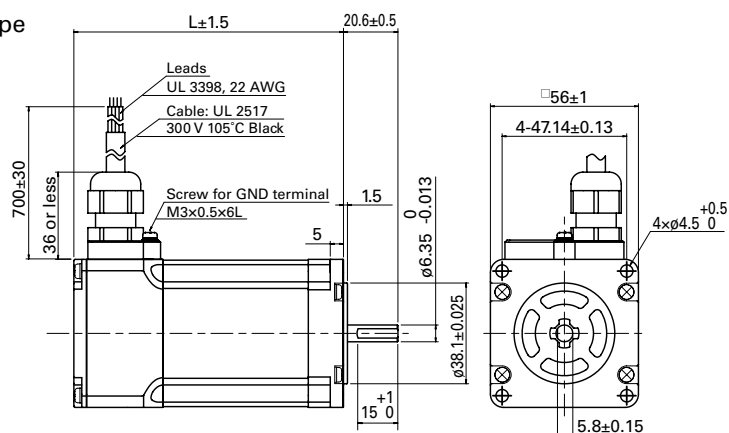


Constant current circuit  
Input voltage: 100 VAC  
Winding current: 3 A/phase, At 2-phase excitation (full step)  
Pull-out torque:  $J_L = 7.4 \times 10^{-4} \text{ kg} \cdot \text{m}^2$  (with rubber coupling used)  
fs: Maximum starting pulse rate with no load

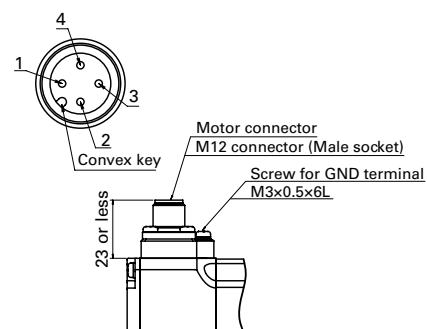
# Dimensions Unit: mm

## 56 mm sq.

Cable type



Connector type



| Model no.     |                | Motor length (L) |
|---------------|----------------|------------------|
| Cable type    | Connector type |                  |
| SP2563-5 □ 60 | SP2563-5 □ 00  | 80               |
| SP2566-5 □ 60 | SP2566-5 □ 00  | 102              |

## Compatible drivers

- For motors SP256 □ -52 □ 0 (3 A/phase) or SP256 □ -50 □ 0 (1 A/phase)...

A driver is to be provided by the customer.

- For motors SP256 □ -51 □ 0 (2 A/phase)...

Model no.: BS1D200P10 (DC input)

Operating current selection switch setting: 0

Note: The characteristics shown above are calculated using our experimental circuit.

# 86 mm sq.

1.8°/step

RoHS

Bipolar



Custom options

Custom shaft

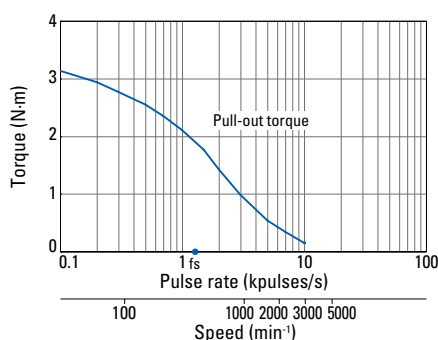
Note: Customization feasibility depends on the model number and quantity. Contact us for details.

| Model no.   |                | Holding torque at 2-phase excitation | Rated current | Winding resistance |         | Winding inductance | Rotor inertia                       | Mass | Allowable thrust load | Allowable radial load |
|-------------|----------------|--------------------------------------|---------------|--------------------|---------|--------------------|-------------------------------------|------|-----------------------|-----------------------|
| Cable type  | Connector type | N·m or more                          | A/phase       | Ω/phase            | Ω/phase | mH/phase           | ×10 <sup>-4</sup> kg·m <sup>2</sup> | kg   | N                     | N                     |
| SP2861-5060 | SP2861-5000    | 3.3                                  | 2             | 2.1                | 2.05    | 15                 | 1.48                                | 1.95 | 60                    | 200                   |
| SP2861-5160 | SP2861-5100    | 3.3                                  | 4             | 0.61               | 0.56    | 3.7                | 1.48                                | 1.95 | 60                    | 200                   |
| SP2861-5260 | —              | 3.3                                  | 6             | 0.36               | —       | 1.7                | 1.48                                | 1.95 | 60                    | 200                   |
| SP2862-5060 | SP2862-5000    | 6.4                                  | 2             | 3.2                | 3.2     | 25                 | 3                                   | 3.1  | 60                    | 200                   |
| SP2862-5160 | SP2862-5100    | 6.4                                  | 4             | 0.85               | 0.83    | 6.4                | 3                                   | 3.1  | 60                    | 200                   |
| SP2862-5260 | —              | 6.4                                  | 6             | 0.41               | —       | 2.8                | 3                                   | 3.1  | 60                    | 200                   |
| SP2863-5060 | SP2863-5000    | 9                                    | 2             | 4                  | 4       | 32                 | 4.5                                 | 4.2  | 60                    | 200                   |
| SP2863-5160 | SP2863-5100    | 9                                    | 4             | 1.05               | 1       | 7.9                | 4.5                                 | 4.2  | 60                    | 200                   |
| SP2863-5260 | —              | 9                                    | 6             | 0.53               | —       | 3.8                | 4.5                                 | 4.2  | 60                    | 200                   |

- Models with a brake, encoder, or oil seal have different model nos., rotor inertia, and mass.
- Connector-type models are available for 4 A or lower rated voltages.

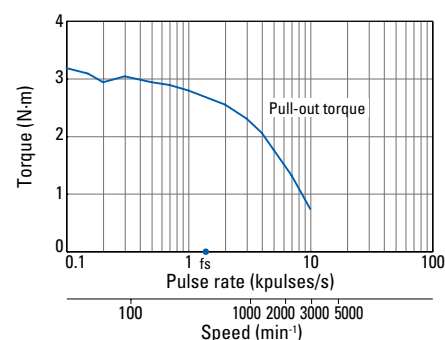
## Characteristics

SP2861-5000  
SP2861-5060



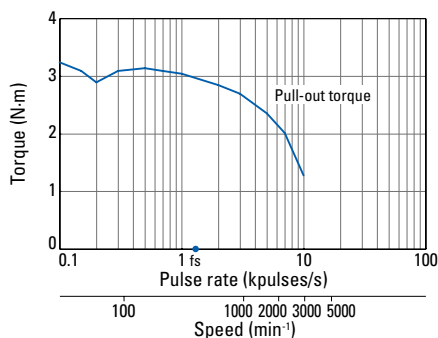
Constant current circuit  
Input voltage: 100 VAC,  
Winding current: 2 A/phase, At 2-phase excitation (full step)  
Pull-out torque:  $J_L=15.3 \times 10^{-4} \text{kg} \cdot \text{m}^2$  (with rubber coupling used)  
 $f_s$ : Maximum starting pulse rate with no load

SP2861-5100  
SP2861-5160



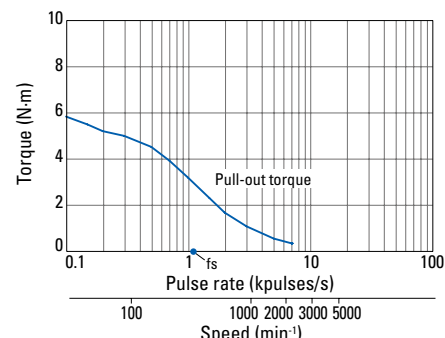
Constant current circuit  
Input voltage: 100 VAC,  
Winding current: 4 A/phase, At 2-phase excitation (full step)  
Pull-out torque:  $J_L=15.3 \times 10^{-4} \text{kg} \cdot \text{m}^2$  (with rubber coupling used)  
 $f_s$ : Maximum starting pulse rate with no load

SP2861-5260



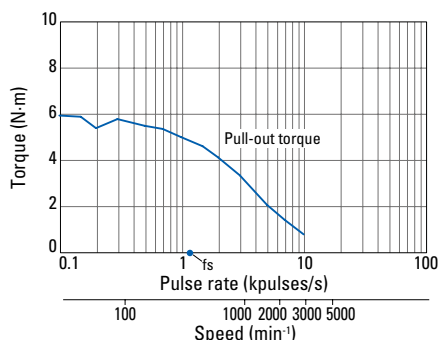
Constant current circuit  
Input voltage: 100 VAC  
Winding current: 6 A/phase, At 2-phase excitation (full step)  
Pull-out torque:  $J_L=15.3 \times 10^{-4} \text{kg} \cdot \text{m}^2$  (with rubber coupling used)  
 $f_s$ : Maximum starting pulse rate with no load

SP2862-5000  
SP2862-5060



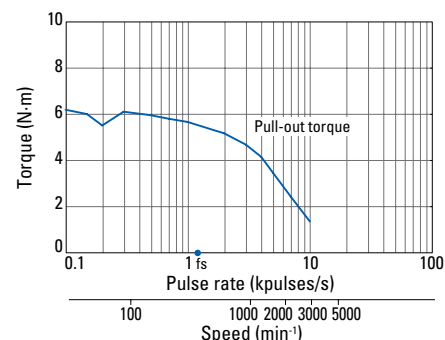
Constant current circuit  
Input voltage: 100 VAC  
Winding current: 2 A/phase, At 2-phase excitation (full step)  
Pull-out torque:  $J_L=15.3 \times 10^{-4} \text{kg} \cdot \text{m}^2$  (with rubber coupling used)  
 $f_s$ : Maximum starting pulse rate with no load

SP2862-5100  
SP2862-5160



Constant current circuit  
Input voltage: 100 VAC,  
Winding current: 4 A/phase, At 2-phase excitation (full step)  
Pull-out torque:  $J_L=15.3 \times 10^{-4} \text{kg} \cdot \text{m}^2$  (with rubber coupling used)  
 $f_s$ : Maximum starting pulse rate with no load

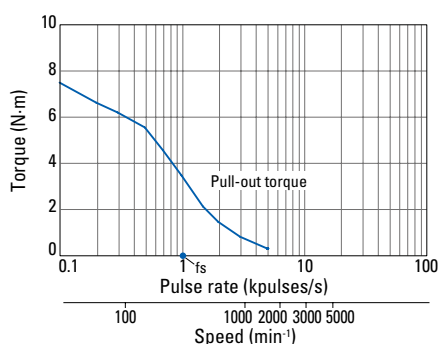
SP2862-5260



Constant current circuit  
Input voltage: 100 VAC  
Winding current: 6 A/phase, At 2-phase excitation (full step)  
Pull-out torque:  $J_L=15.3 \times 10^{-4} \text{kg} \cdot \text{m}^2$  (with rubber coupling used)  
 $f_s$ : Maximum starting pulse rate with no load

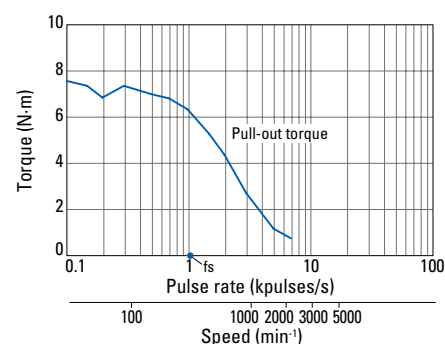
## Characteristics

### SP2863-5000 SP2863-5060



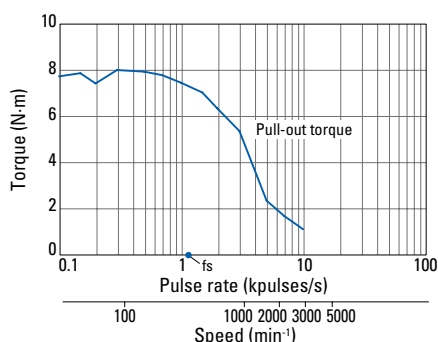
Constant current circuit  
Input voltage: 100 VAC  
Winding current: 2 A/phase, At 2-phase excitation (full step)  
Pull-out torque:  $J_L=44 \times 10^{-4} \text{ kg} \cdot \text{m}^2$  (with rubber coupling used)  
fs: Maximum starting pulse rate with no load

### SP2863-5100 SP2863-5160



Constant current circuit  
Input voltage: 100 VAC  
Winding current: 4 A/phase, At 2-phase excitation (full step)  
Pull-out torque:  $J_L=44 \times 10^{-4} \text{ kg} \cdot \text{m}^2$  (with rubber coupling used)  
fs: Maximum starting pulse rate with no load

### SP2863-5260

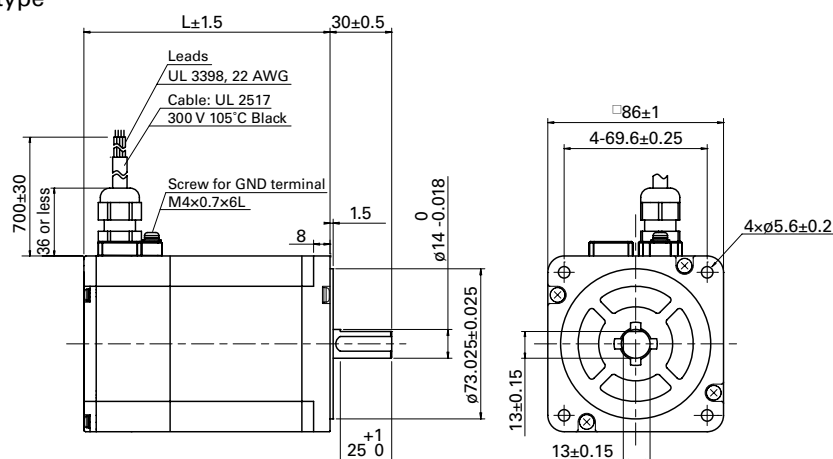


Constant current circuit  
Input voltage: 100 VAC  
Winding current: 6 A/phase, At 2-phase excitation (full step)  
Pull-out torque:  $J_L=44 \times 10^{-4} \text{ kg} \cdot \text{m}^2$  (with rubber coupling used)  
fs: Maximum starting pulse rate with no load

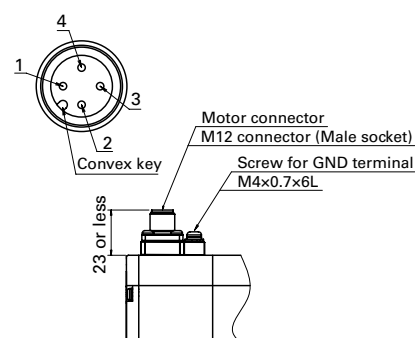
## Dimensions Unit: mm

### 86 mm sq.

#### Cable type



#### Connector type



| Model no.     | Connector type | Motor length (L) |
|---------------|----------------|------------------|
| SP2861-5 □ 60 | SP2861-5 □ 00  | 89.5             |
| SP2862-5 □ 60 | SP2862-5 □ 00  | 120              |
| SP2863-5 □ 60 | SP2863-5 □ 00  | 150              |

## Compatible drivers

A driver is to be provided by the customer.

Note: The characteristics shown above are calculated using our experimental circuit.



# In-Vacuum Stepping Motors

Custom product



## Features

- These can be driven in vacuum environments without requiring a vacuum feedthrough. These stepping motors can be used as an actuator suitable for vacuum environments while maintaining the feature of a stepping motor—easy high-precision open-loop control.
- We also offer customization for use in a wide range of pressure environments from low vacuum to ultra-high vacuum.
- Baking at 200°C is possible.
- No significant size change from regular stepping motors.

## Operable pressure environments

| Low vacuum      |                 |                 | Medium vacuum   |                 |   | High vacuum      |                  |                  |                  | Ultra-high vacuum |                  |                  |                       |
|-----------------|-----------------|-----------------|-----------------|-----------------|---|------------------|------------------|------------------|------------------|-------------------|------------------|------------------|-----------------------|
| 10 <sup>5</sup> | 10 <sup>4</sup> | 10 <sup>3</sup> | 10 <sup>2</sup> | 10 <sup>1</sup> | 1 | 10 <sup>-1</sup> | 10 <sup>-2</sup> | 10 <sup>-3</sup> | 10 <sup>-4</sup> | 10 <sup>-5</sup>  | 10 <sup>-6</sup> | 10 <sup>-7</sup> | 10 <sup>-8</sup> [Pa] |

## Applications

Ideal for the following applications. Contact us to discuss your particular application environment needs.

- Semiconductor manufacturing equipment
- Satellite robots
- Electron microscopes
- Large-scale research facilities such as accelerators, synchrotron radiation analysis equipment, etc.

## Motor size

42 mm sq. to ø106 mm

# Synchronous Motors

Custom product



## Features

- Synchronous motors rotate at a constant speed in proportion to the AC power frequency without been affected by voltage or load level variations, preventing motor step-out.
- These motors can drive at ultra-low speeds with high torque without using gears.
- Since an AC power supply can be directly connected to the motor, a drive circuit is not required, simplifying your system.
- In addition to 2-phase motors, we also offer 3-phase motors, which don't require a phase shifter.
- Certification for safety standards acquired.

## Applications

Ideal for the following applications. Contact us to discuss your particular application environment needs.

- Belt conveyors
- Printers
- Cryopumps
- Cryocoolers
- Switching devices

## Motor size

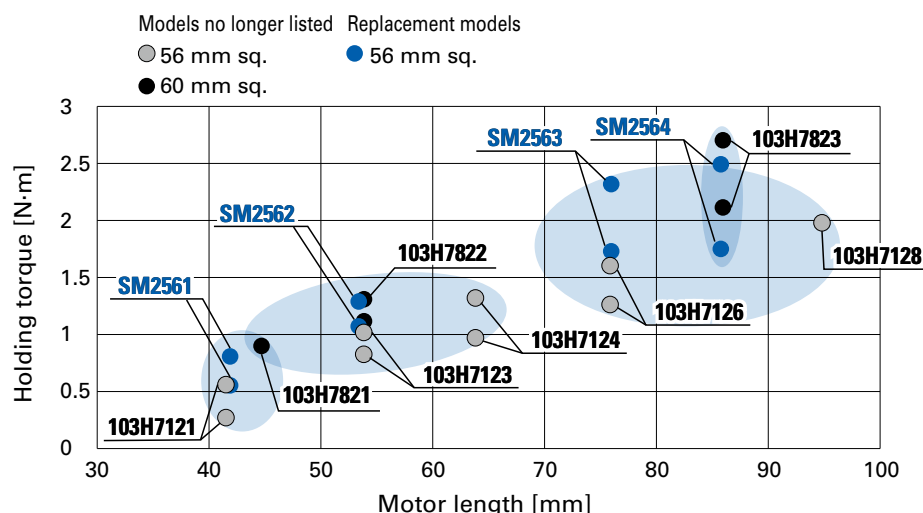
56 mm sq. to ø106 mm

# Models No Longer Listed and Their Replacement Models

| Models no longer listed       |               |                                      |               |      |                  | Replacement models                                                     |              |                                      |               |      |                  |       |
|-------------------------------|---------------|--------------------------------------|---------------|------|------------------|------------------------------------------------------------------------|--------------|--------------------------------------|---------------|------|------------------|-------|
| 56 mm sq. unipolar, lead type |               |                                      |               |      |                  | 56 mm sq. unipolar, connector type    Contact us for lead-type motors. |              |                                      |               |      |                  |       |
| Model no.                     |               | Holding torque at 2-phase excitation | Rated current | Mass | Motor length (L) | Model no.                                                              |              | Holding torque at 2-phase excitation | Rated current | Mass | Motor length (L) | Page  |
| Single shaft                  | Dual shaft    | N-m or more                          | A/phase       | kg   | mm               | Single shaft                                                           | Dual shaft   | N-m or more                          | A/phase       | kg   | mm               |       |
| 103H7121-0140                 | 103H7121-0110 | 0.39                                 | 1             | 0.47 | 41.8             | SM2561C10U41                                                           | SM2561C10U11 | 0.53                                 | 1             | 0.49 | 41.8             | p. 50 |
| 103H7121-0440                 | 103H7121-0410 | 0.39                                 | 2             | 0.47 | 41.8             | SM2561C20U41                                                           | SM2561C20U11 | 0.53                                 | 2             | 0.49 | 41.8             | p. 50 |
| 103H7121-0740                 | 103H7121-0710 | 0.39                                 | 3             | 0.47 | 41.8             | SM2561C30U41                                                           | SM2561C30U11 | 0.53                                 | 3             | 0.49 | 41.8             | p. 50 |
| 103H7123-0140                 | 103H7123-0110 | 0.83                                 | 1             | 0.65 | 53.8             | SM2562C10U41                                                           | SM2562C10U11 | 1.1                                  | 1             | 0.69 | 53.8             | p. 50 |
| 103H7123-0440                 | 103H7123-0410 | 0.83                                 | 2             | 0.65 | 53.8             | SM2562C20U41                                                           | SM2562C20U11 | 1.1                                  | 2             | 0.69 | 53.8             | p. 50 |
| 103H7123-0740                 | 103H7123-0710 | 0.78                                 | 3             | 0.65 | 53.8             | SM2562C30U41                                                           | SM2562C30U11 | 1.1                                  | 3             | 0.69 | 53.8             | p. 50 |
| 103H7124-0140                 | 103H7124-0110 | 0.98                                 | 1             | 0.8  | 63.8             | SM2562C10U41                                                           | SM2562C10U11 | 1.1                                  | 1             | 0.69 | 53.8             | p. 50 |
| 103H7124-0440                 | 103H7124-0410 | 0.98                                 | 2             | 0.8  | 63.8             | SM2562C20U41                                                           | SM2562C20U11 | 1.1                                  | 2             | 0.69 | 53.8             | p. 50 |
| 103H7124-0740                 | 103H7124-0710 | 0.98                                 | 3             | 0.8  | 63.8             | SM2562C30U41                                                           | SM2562C30U11 | 1.1                                  | 3             | 0.69 | 53.8             | p. 50 |
| 103H7126-0140                 | 103H7126-0110 | 1.27                                 | 1             | 0.98 | 75.8             | SM2563C10U41                                                           | SM2563C10U11 | 1.7                                  | 1             | 1.1  | 75.8             | p. 50 |
| 103H7126-0440                 | 103H7126-0410 | 1.27                                 | 2             | 0.98 | 75.8             | SM2563C20U41                                                           | SM2563C20U11 | 1.7                                  | 2             | 1.1  | 75.8             | p. 50 |
| 103H7126-0740                 | 103H7126-0710 | 1.27                                 | 3             | 0.98 | 75.8             | SM2563C30U41                                                           | SM2563C30U11 | 1.7                                  | 3             | 1.1  | 75.8             | p. 50 |

| 56 mm sq. bipolar, lead type |               |                                      |               |      |                  | 56 mm sq. bipolar, connector type    Contact us for lead-type motors. |              |                                      |               |      |                  |       |
|------------------------------|---------------|--------------------------------------|---------------|------|------------------|-----------------------------------------------------------------------|--------------|--------------------------------------|---------------|------|------------------|-------|
| Model no.                    |               | Holding torque at 2-phase excitation | Rated current | Mass | Motor length (L) | Model no.                                                             |              | Holding torque at 2-phase excitation | Rated current | Mass | Motor length (L) | Page  |
| Single shaft                 | Dual shaft    | N-m or more                          | A/phase       | kg   | mm               | Single shaft                                                          | Dual shaft   | N-m or more                          | A/phase       | kg   | mm               |       |
| 103H7121-5640                | 103H7121-5610 | 0.55                                 | 1             | 0.47 | 41.8             | SM2561C10B41                                                          | SM2561C10B11 | 0.75                                 | 1             | 0.49 | 41.8             | p. 52 |
| 103H7121-5740                | 103H7121-5710 | 0.55                                 | 2             | 0.47 | 41.8             | SM2561C20B41                                                          | SM2561C20B11 | 0.75                                 | 2             | 0.49 | 41.8             | p. 52 |
| 103H7121-5840                | 103H7121-5810 | 0.55                                 | 3             | 0.47 | 41.8             | SM2561C30B41                                                          | SM2561C30B11 | 0.75                                 | 3             | 0.49 | 41.8             | p. 52 |
| 103H7123-5640                | 103H7123-5610 | 1.0                                  | 1             | 0.65 | 53.8             | SM2562C10B41                                                          | SM2562C10B11 | 1.4                                  | 1             | 0.69 | 53.8             | p. 52 |
| 103H7123-5740                | 103H7123-5710 | 1.0                                  | 2             | 0.65 | 53.8             | SM2562C20B41                                                          | SM2562C20B11 | 1.4                                  | 2             | 0.69 | 53.8             | p. 52 |
| 103H7123-5840                | 103H7123-5810 | 1.0                                  | 3             | 0.65 | 53.8             | SM2562C30B41                                                          | SM2562C30B11 | 1.4                                  | 3             | 0.69 | 53.8             | p. 52 |
| 103H7126-5640                | 103H7126-5610 | 1.6                                  | 1             | 0.98 | 75.8             | SM2563C10B41                                                          | SM2563C10B11 | 2.35                                 | 1             | 1.1  | 75.8             | p. 52 |
| 103H7126-5740                | 103H7126-5710 | 1.6                                  | 2             | 0.98 | 75.8             | SM2563C20B41                                                          | SM2563C20B11 | 2.35                                 | 2             | 1.1  | 75.8             | p. 52 |
| 103H7126-5840                | 103H7126-5810 | 1.6                                  | 3             | 0.98 | 75.8             | SM2563C30B41                                                          | SM2563C30B11 | 2.35                                 | 3             | 1.1  | 75.8             | p. 52 |
| 103H7128-5640                | 103H7128-5610 | 2.0                                  | 1             | 1.3  | 94.8             | SM2563C10B41                                                          | SM2563C10B11 | 2.35                                 | 1             | 1.1  | 75.8             | p. 52 |
| 103H7128-5740                | 103H7128-5710 | 2.0                                  | 2             | 1.3  | 94.8             | SM2563C20B41                                                          | SM2563C20B11 | 2.35                                 | 2             | 1.1  | 75.8             | p. 52 |
| 103H7128-5840                | 103H7128-5810 | 2.0                                  | 3             | 1.3  | 94.8             | SM2563C30B41                                                          | SM2563C30B11 | 2.35                                 | 3             | 1.1  | 75.8             | p. 52 |

Replacement of 56 and 60 mm sq. motors



| Models no longer listed            |               |                                      |               |      |                  | Replacement models                 |              |                                      |               |      |                  |       |
|------------------------------------|---------------|--------------------------------------|---------------|------|------------------|------------------------------------|--------------|--------------------------------------|---------------|------|------------------|-------|
| 60 mm sq. unipolar, connector type |               |                                      |               |      |                  | 56 mm sq. unipolar, connector type |              |                                      |               |      |                  |       |
| Model no.                          |               | Holding torque at 2-phase excitation | Rated current | Mass | Motor length (L) | Model no.                          |              | Holding torque at 2-phase excitation | Rated current | Mass | Motor length (L) | Page  |
| Single shaft                       | Dual shaft    | N-m or more                          | A/phase       | kg   | mm               | Single shaft                       | Dual shaft   | N-m or more                          | A/phase       | kg   | mm               |       |
| 103H7821-0140                      | 103H7821-0110 | 0.78                                 | 1             | 0.6  | 44.8             | SM2561C10U41                       | SM2561C10U11 | 0.53                                 | 1             | 0.49 | 41.8             | p. 50 |
| 103H7821-0440                      | 103H7821-0410 | 0.78                                 | 2             | 0.6  | 44.8             | SM2561C20U41                       | SM2561C20U11 | 0.53                                 | 2             | 0.49 | 41.8             | p. 50 |
| 103H7821-0740                      | 103H7821-0710 | 0.78                                 | 3             | 0.6  | 44.8             | SM2561C30U41                       | SM2561C30U11 | 0.53                                 | 3             | 0.49 | 41.8             | p. 50 |
| 103H7822-0140                      | 103H7822-0110 | 1.17                                 | 1             | 0.77 | 53.8             | SM2562C10U41                       | SM2562C10U11 | 1.1                                  | 1             | 0.69 | 53.8             | p. 50 |
| 103H7822-0440                      | 103H7822-0410 | 1.17                                 | 2             | 0.77 | 53.8             | SM2562C20U41                       | SM2562C20U11 | 1.1                                  | 2             | 0.69 | 53.8             | p. 50 |
| 103H7822-0740                      | 103H7822-0710 | 1.17                                 | 3             | 0.77 | 53.8             | SM2562C30U41                       | SM2562C30U11 | 1.1                                  | 3             | 0.69 | 53.8             | p. 50 |
| 103H7823-0140                      | 103H7823-0110 | 2.1                                  | 1             | 1.34 | 85.8             | SM2564C10U41                       | SM2564C10U11 | 1.75                                 | 1             | 1.27 | 85.8             | p. 50 |
| 103H7823-0440                      | 103H7823-0410 | 2.1                                  | 2             | 1.34 | 85.8             | SM2564C20U41                       | SM2564C20U11 | 1.75                                 | 2             | 1.27 | 85.8             | p. 50 |
| 103H7823-0740                      | 103H7823-0710 | 2.1                                  | 3             | 1.34 | 85.8             | SM2564C30U41                       | SM2564C30U11 | 1.75                                 | 3             | 1.27 | 85.8             | p. 50 |

| 60 mm sq. unipolar, lead type<br>NEMA 23 mounting compatible (47.14 mm) |               |                                      |               |      |                  | 56 mm sq. unipolar, connector type    Contact us for lead-type motors. |              |                                      |               |      |                  |       |
|-------------------------------------------------------------------------|---------------|--------------------------------------|---------------|------|------------------|------------------------------------------------------------------------|--------------|--------------------------------------|---------------|------|------------------|-------|
| Model no.                                                               |               | Holding torque at 2-phase excitation | Rated current | Mass | Motor length (L) | Model no.                                                              |              | Holding torque at 2-phase excitation | Rated current | Mass | Motor length (L) | Page  |
| Single shaft                                                            | Dual shaft    | N-m or more                          | A/phase       | kg   | mm               | Single shaft                                                           | Dual shaft   | N-m or more                          | A/phase       | kg   | mm               |       |
| 103H7821-0160                                                           | 103H7821-0130 | 0.78                                 | 1             | 0.6  | 43.5             | SM2561C10U41                                                           | SM2561C10U11 | 0.53                                 | 1             | 0.49 | 41.8             | p. 50 |
| 103H7821-0460                                                           | 103H7821-0430 | 0.78                                 | 2             | 0.6  | 43.5             | SM2561C20U41                                                           | SM2561C20U11 | 0.53                                 | 2             | 0.49 | 41.8             | p. 50 |
| 103H7821-0760                                                           | 103H7821-0730 | 0.78                                 | 3             | 0.6  | 43.5             | SM2561C30U41                                                           | SM2561C30U11 | 0.53                                 | 3             | 0.49 | 41.8             | p. 50 |
| 103H7822-0160                                                           | 103H7822-0130 | 1.17                                 | 1             | 0.77 | 52.5             | SM2562C10U41                                                           | SM2562C10U11 | 1.1                                  | 1             | 0.69 | 53.8             | p. 50 |
| 103H7822-0460                                                           | 103H7822-0430 | 1.17                                 | 2             | 0.77 | 52.5             | SM2562C20U41                                                           | SM2562C20U11 | 1.1                                  | 2             | 0.69 | 53.8             | p. 50 |
| 103H7822-0760                                                           | 103H7822-0730 | 1.17                                 | 3             | 0.77 | 52.5             | SM2562C30U41                                                           | SM2562C30U11 | 1.1                                  | 3             | 0.69 | 53.8             | p. 50 |
| 103H7823-0160                                                           | 103H7823-0130 | 2.1                                  | 1             | 1.34 | 84.5             | SM2564C10U41                                                           | SM2564C10U11 | 1.75                                 | 1             | 1.27 | 85.8             | p. 50 |
| 103H7823-0460                                                           | 103H7823-0430 | 2.1                                  | 2             | 1.34 | 84.5             | SM2564C20U41                                                           | SM2564C20U11 | 1.75                                 | 2             | 1.27 | 85.8             | p. 50 |
| 103H7823-0760                                                           | 103H7823-0730 | 2.1                                  | 3             | 1.34 | 84.5             | SM2564C30U41                                                           | SM2564C30U11 | 1.75                                 | 3             | 1.27 | 85.8             | p. 50 |

| 60 mm sq. bipolar, connector type |               |                                      |               |      |                  | 56 mm sq. bipolar, connector type |              |                                      |               |      |                  |       |
|-----------------------------------|---------------|--------------------------------------|---------------|------|------------------|-----------------------------------|--------------|--------------------------------------|---------------|------|------------------|-------|
| Model no.                         |               | Holding torque at 2-phase excitation | Rated current | Mass | Motor length (L) | Model no.                         |              | Holding torque at 2-phase excitation | Rated current | Mass | Motor length (L) | Page  |
| Single shaft                      | Dual shaft    | N-m or more                          | A/phase       | kg   | mm               | Single shaft                      | Dual shaft   | N-m or more                          | A/phase       | kg   | mm               |       |
| 103H7821-5740                     | 103H7821-5710 | 0.88                                 | 2             | 0.6  | 44.8             | SM2561C20B41                      | SM2561C20B11 | 0.75                                 | 2             | 0.49 | 41.8             | p. 52 |
| 103H7821-1740                     | 103H7821-1710 | 0.88                                 | 4             | 0.6  | 44.8             | SM2561C40B41                      | SM2561C40B11 | 0.75                                 | 4             | 0.49 | 41.8             | p. 52 |
| 103H7822-5740                     | 103H7822-5710 | 1.37                                 | 2             | 0.77 | 53.8             | SM2562C20B41                      | SM2562C20B11 | 1.4                                  | 2             | 0.69 | 53.8             | p. 52 |
| 103H7822-1740                     | 103H7822-1710 | 1.37                                 | 4             | 0.77 | 53.8             | SM2562C40B41                      | SM2562C40B11 | 1.4                                  | 4             | 0.69 | 53.8             | p. 52 |
| 103H7823-5740                     | 103H7823-5710 | 2.7                                  | 2             | 1.34 | 85.8             | SM2564C20B41                      | SM2564C20B11 | 2.5                                  | 2             | 1.27 | 85.8             | p. 52 |
| 103H7823-1740                     | 103H7823-1710 | 2.7                                  | 4             | 1.34 | 85.8             | SM2564C40B41                      | SM2564C40B11 | 2.5                                  | 4             | 1.27 | 85.8             | p. 52 |

| 60 mm sq. bipolar, lead type<br>NEMA 23 mounting compatible (47.14 mm) |               |                                      |               |      |                  | 56 mm sq. bipolar, connector type    Contact us for lead-type motors. |              |                                      |               |      |                  |       |
|------------------------------------------------------------------------|---------------|--------------------------------------|---------------|------|------------------|-----------------------------------------------------------------------|--------------|--------------------------------------|---------------|------|------------------|-------|
| Model no.                                                              |               | Holding torque at 2-phase excitation | Rated current | Mass | Motor length (L) | Model no.                                                             |              | Holding torque at 2-phase excitation | Rated current | Mass | Motor length (L) | Page  |
| Single shaft                                                           | Dual shaft    | N-m or more                          | A/phase       | kg   | mm               | Single shaft                                                          | Dual shaft   | N-m or more                          | A/phase       | kg   | mm               |       |
| 103H7821-5760                                                          | 103H7821-5730 | 0.88                                 | 2             | 0.6  | 43.5             | SM2561C20B41                                                          | SM2561C20B11 | 0.75                                 | 2             | 0.49 | 41.8             | p. 52 |
| 103H7821-1760                                                          | 103H7821-1730 | 0.88                                 | 4             | 0.6  | 43.5             | SM2561C40B41                                                          | SM2561C40B11 | 0.75                                 | 4             | 0.49 | 41.8             | p. 52 |
| 103H7822-5760                                                          | 103H7822-5730 | 1.37                                 | 2             | 0.77 | 52.5             | SM2562C20B41                                                          | SM2562C20B11 | 1.4                                  | 2             | 0.69 | 53.8             | p. 52 |
| 103H7822-1760                                                          | 103H7822-1730 | 1.37                                 | 4             | 0.77 | 52.5             | SM2562C40B41                                                          | SM2562C40B11 | 1.4                                  | 4             | 0.69 | 53.8             | p. 52 |
| 103H7823-5760                                                          | 103H7823-5730 | 2.7                                  | 2             | 1.34 | 84.5             | SM2564C20B41                                                          | SM2564C20B11 | 2.5                                  | 2             | 1.27 | 85.8             | p. 52 |
| 103H7823-1760                                                          | 103H7823-1730 | 2.7                                  | 4             | 1.34 | 84.5             | SM2564C40B41                                                          | SM2564C40B11 | 2.5                                  | 4             | 1.27 | 85.8             | p. 52 |

| ø86 mm bipolar, lead type |               |                                      |               |      |                  | 86 mm sq. bipolar, lead type |             |                                      |               |      |                  |       |
|---------------------------|---------------|--------------------------------------|---------------|------|------------------|------------------------------|-------------|--------------------------------------|---------------|------|------------------|-------|
| Model no.                 |               | Holding torque at 2-phase excitation | Rated current | Mass | Motor length (L) | Model no.                    |             | Holding torque at 2-phase excitation | Rated current | Mass | Motor length (L) | Page  |
| Single shaft              | Dual shaft    | N-m or more                          | A/phase       | kg   | mm               | Single shaft                 | Dual shaft  | N-m or more                          | A/phase       | kg   | mm               |       |
| 103H8221-6240             | 103H8221-6210 | 2.74                                 | 6             | 1.5  | 62               | SM2861-5251                  | SM2861-5221 | 3.3                                  | 6             | 1.75 | 66               | p. 66 |
| 103H8222-6340             | 103H8222-6310 | 5.09                                 | 6             | 2.5  | 92.2             | SM2862-5251                  | SM2862-5221 | 6.4                                  | 6             | 2.9  | 96.5             | p. 66 |
| 103H8223-6340             | 103H8223-6310 | 7.44                                 | 6             | 3.5  | 125.9            | SM2863-5251                  | SM2863-5221 | 9                                    | 6             | 4.0  | 127              | p. 66 |

# Safety Precautions

The products in this catalog are designed to be used with general industrial equipment. When using them, pay sufficient attention to the following points.

- Read the included Instruction Manual carefully before installing, assembling, and using the product for proper use.
- Do not modify or alter the product in any way.
- Contact us or your point of sale for installation or maintenance services of the product.
- Consult us when using the product for the following uses, as these require special considerations for operations, maintenance, and management such as redundancy and emergency power generators.
  - ❶ Use in medical equipment that may have an effect on human life or the human body
  - ❷ Use in transportation systems or transport-related equipment such as trains or elevators that may have an effect on human life or the human body
  - ❸ Use in computer systems that may have an impact on society or on the public
  - ❹ Use in other devices that have a major impact on human safety or on maintaining public operations
- In addition to the above, contact us or your point of sale for use in an environment where vibrations occur, such as in automobiles or transportation.
- For use in space, aviation, or nuclear power-related applications, contact us or your point of sale.
- The products listed in this catalog fall into the category 16 of Appended Table 1 of the Export Trade Control Order. To export these products as an individual part or to export a device into which they are assembled, the "Inform Requirements" and "Objective Requirements"—established by the Ministry of Economy, Trade and Industry of Japan based on the "Catch-all Controls"—must be studied for applicability. Accordingly, appropriate export formalities must be performed.

# Safety Precautions

## Warning Labels on Products

Either or all of the following symbols are labeled on products depending on the model of driver or stepping motor.



This label is attached in the vicinity of high-voltage portions such as charging or cover-protected parts, to indicate locations with risk of electric shock.



This label is attached in the vicinity of the grounding terminals of drivers to indicate that grounding is required.



This label is attached to the portion of drivers where a voltage of 42.4 VAC or 60 VDC or more is applied, drawing attention to the risk of electric shock.



Indicates that the stepping motor may get hot, resulting in burns.



Indicates that the stepping motor should be grounded.

## Safety Alert Symbols

The following safety symbols are used in the manual to indicate different hazardous situations and prohibited/required actions.

**DANGER** Indicates hazards that could cause severe bodily injury or death as a result of failure to follow the instructions.

**CAUTION** Indicates possible hazards that could cause moderate bodily injury or only property damage as a result of failure to follow the instructions.

Note that even items with a **CAUTION** symbol could potentially lead to serious outcomes, depending on the situation. They all indicate important situations, so be sure to observe them.

**PROHIBITED** Indicates actions that must not be taken.

**COMPULSORY** Indicates actions that must be taken.

## DANGER

### General

1. Do not use the product in an explosive, flammable or corrosive atmosphere, watery place or near a combustible material. Failure to follow this may cause injury or fire.
2. Only technically qualified personnel should transport, install, wire, operate, or perform maintenance and inspection on the product. Failure to follow this may cause electric shock, injury, or fire.
3. Do not work on wiring, maintenance servicing, or inspection with power on. Perform either of those five minutes after turning the power off. Failure to follow this may cause electrical shock.
4. When the protective functions of the product is activated, turn the power off immediately and eliminate the cause. If continuing the operation without eliminating the cause, the product may operate improperly and cause injury or a breakdown of the system devices.
5. Stepping motor may run out of order when operating and stopping depending on the magnitude of the load. Put the product into use after sufficient trial test operation in the maximum planned load conditions to check that the product can handle the load. Doing otherwise may cause a breakdown of the system. (Should the product run out of order in the use to drive upward/downward, it may cause a fall of the load.)
6. Do not touch the internal parts of the driver. Failure to follow this may cause electrical shock.

### Wiring

7. Do not connect the stepping motor directly to a mains outlet. Failure to follow this may cause electric shock, injury, or fire. Stepping motors should be powered by stepping drivers (except for synchronous motors).
8. Use an input voltage within the rated voltage range. Using otherwise may cause fire or an electric shock.
9. Connect the driver and stepping motor to the ground. Failure to follow this may cause electrical shock.
10. Do not damage, apply excessive stresses, put heavy things on, or tuck down cables. Failure to follow this may cause electrical shock.
11. Perform wiring with the power cable as instructed by the wiring diagram or the Instruction Manual. Failure to follow this may cause electric shock or fire.
12. Our stepping motor cables are for fixed-wiring use, so do not use products in applications where flex cables are required. Failure to follow this may cause electric shock, injury, or fire.

### Operation

13. Be sure not to touch the rotating part of the stepping motor during its operation. Failure to do so may cause injury.
14. Do not reach or touch the electric terminals while electric power is on. Failure to follow this may cause electrical shock.
15. Never disconnect any of the connectors while electric power is on. Failure to follow this may cause electric shock or product damage.
16. Do not operate products with live parts exposed. Failure to follow this may cause electrical shock.
17. If smoke, fire, unusual smells, or unusual sounds are produced from the driver or stepping motor, turn off the power and stop using them immediately. Failure to follow this may cause electric shock, injury, or fire.

## CAUTION

### General

1. Prior to installation, operation, maintenance servicing or inspection, be sure to read the Instruction Manual and follow the instructions. Failure to follow this may cause electric shock, injury, or fire.
2. Do not use the driver or the stepping motor in conditions that exceed the specification values. Failure to follow this may cause electric shock, injury, or fire.
3. Do not insert a finger or an object into the opening of products. Failure to follow this may cause electric shock, injury, or fire.
4. Do not use a damaged driver or stepping motor. Doing so may cause injury or fire.

5. Use the driver and stepping motor in the designated combination. Failure to follow this may cause fire or product failures.
6. The driver, motor, and peripheral devices become hot during operation, so use them carefully. Otherwise it may result in a burn.
7. Never disassemble, repair, modify, or alter products. Failure to follow this may cause electric shock, injury, or fire.
8. Do not remove the product name plate. Using products with incorrect ratings may result in fire.
9. Be careful that this product does not fall or tip over when handling, as this can be dangerous.

### Unpacking

10. Unpack the box right side up. Failure to do so may result in injury.
11. Confirm that the product you received is the one that you have ordered. Installing an incorrect product may cause a breakdown.

### Wiring

12. Do not perform measurements of insulation resistance or dielectric strength. Failure to follow this may cause product damage. Contact us or your point of sale instead, if such a measurement is required.
13. Perform wiring work according to local standards of electrical installations. Failure to follow this may cause motor burnout or fire.
14. Perform wiring correctly and securely. Incorrect wiring may cause the stepping motor to run out of control, resulting in injury.
15. Insulate the attached condenser and external resistance connection terminals. Failure to follow this may cause electrical shock.

### Installation

16. Do not climb or attach a heavy article on the product. Failure to do so may cause injury.
17. Do not obstruct the air intake and exhaust vents. Failure to follow this may cause fire.
18. Make sure to use the specified driver mounting direction. Failure to follow this may cause product failures.
19. Keep a distance as instructed by the Instruction Manual for the driver from the inner surface of the control console or other devices. Failure to follow this may cause product failures.
20. Place the product with great care so as to prevent from danger such as a tumble or a turnover.
21. Install the product to incombustible materials such as metals. Failure to do so may cause fire, injury, or device breakdown.
22. Do not place combustible material around this product. Failure to do so may result in fire or burns.
23. Be sure to provide an adequate ventilation path when installing this product, and do not block the intake and exhaust ports. Failure to do so may result in electric shock, fire, or device breakdown.
24. Confirm the rotating direction before connecting with the mechanical device. Failure to follow this may cause injury or product damage.
25. Do not touch the motor output spindle (including the key slot and gears) with your bare hand. Failure to do so may cause injury.
26. Do not to apply force that exceeds the specified allowable loads to the motor output shaft.

### Operation

27. The stepping motor is not equipped with any protective device. Prepare an overvoltage protection device, earth leakage breaker, overheat protection device, and emergency stop device to ensure safe operation. Failure to follow this may cause injury or fire.
28. Do not touch the product for a period after the power is on or has been turned off, since the driver and stepping motor remain at a high temperature. Failure to do so may cause burns. In particular, the temperature rises considerably of the stepping motor depending on the operating conditions. Do not allow the motor surface to exceed the following temperatures:

Thermal class F (+155°C) stepping motors: 125°C

Thermal class B (+130°C) stepping motors: 100°C

Regardless of thermal class, encoder equipped stepping motors: 85°C, in-vacuum stepping motors: 150°C

29. Immediately stop operation in case of anomaly. Failure to do so may cause an electric shock, injury or fire.
30. Do not perform drastic setting changes as such changes may cause unstable operation. Failure to do so may cause injury.

31. During trial operations, firmly stabilize the stepping motor, and confirm operations by disconnecting from the mechanical system before connecting with it. Failure to do so may cause injury.
32. When the alarm has been activated, eliminate the cause and ensure safety before resuming operations. Failure to do so may cause injury.
33. When the electric power recovers after a momentary interruption, do not approach the devices because the system may restart operation by itself. (Set the system so as to secure the safety even when it restarts on such occasions.) Failure to do so may cause injury.
34. Confirm that the electric power supply properly conforms to the product specifications. Failure to follow this may cause product failures.
35. The electromagnetic brake is designed to hold the motor position in place. Do not use it as dynamic braking. Doing so may cause the breakdown of the system.
36. Secure the key when operating the motor with a key. Failure to do so may cause injury.
37. For use in applications where varying loads are applied to the shaft, contact us in advance. Use in environments with varying loads might result in equipment failure.

#### Maintenance

38. Be careful when performing maintenance services or inspection as the driver and stepping motor frames get hot. Failure to do so may cause burns.
39. It is recommended that the electrolytic condenser of the driver is replaced with a new one as preventive maintenance after using for 5 years (the expected life in an average operating environment of 40°C). The expected life of the fuse is 10 years in an average operating environment of 40°C. Thus, periodical replacement is recommended.
40. Contact us or your point of sale for repair. If the product is disassembled by the user, it may become inoperable.

#### Transportation

41. Handle the product with care during transportation so as to prevent from dangers such as tumbling or overturning.
42. Do not hold with the cable or the motor shaft when transporting. Failure to follow this may cause product damage or injury.

#### Disposal

43. Dispose of stepping drivers and motors as industrial waste.

### PROHIBITED

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#### Storage

1. Avoid storing products in locations exposed to rain or water drops, or in an environment with hazardous gas or liquid. Failure to follow this may cause failures.

#### Maintenance

2. Do not disassemble or repair products by yourself. Failure to follow this may cause fire or electric shock.

#### General

3. Do not remove the product name plate. Using products with incorrect ratings may result in fire.

### COMPULSORY

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#### Storage

1. Store the product in a location that is not exposed to sunlight, at a temperature and humidity within the product specifications.
2. If the driver has been stored for a long period (3 years or longer), contact us. The capacitance of electrolytic capacitors can decrease through long-term storage, which may cause malfunctions.

#### Operation

3. Install an external emergency stop circuit to turn the power off if needed.

4. Operate this product within the specified ambient temperature and humidity.

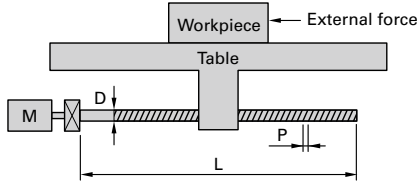
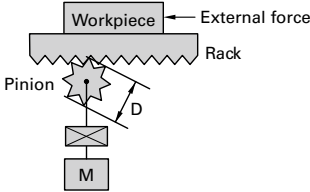
#### Transportation

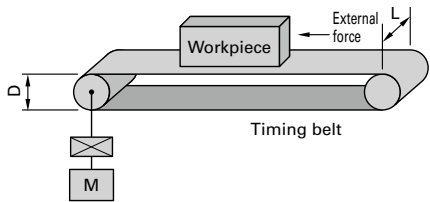
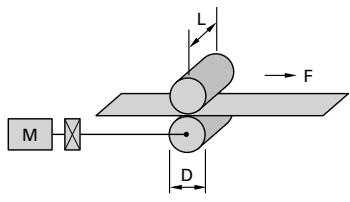
5. Follow the instructions displayed on the package box and avoid excessively stacking boxes.

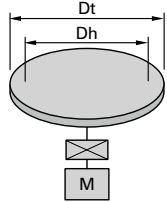


## ■ Selection Guide by Mechanism

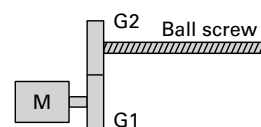
Typical mechanism examples and required selection criteria are shown below. Provide us with these information when consulting us for selection.

| Ball screw                                                                        |        |                   | Rack & Pinion                                                                      |        |                   |
|-----------------------------------------------------------------------------------|--------|-------------------|------------------------------------------------------------------------------------|--------|-------------------|
|  |        |                   |  |        |                   |
| External force                                                                    | F      | N                 | External force                                                                     | F      | N                 |
| Workpiece mass + table mass                                                       | W      | kg                | Workpiece mass + rack mass                                                         | W      | kg                |
| Ball screw diameter                                                               | D      | m                 | Pinion diameter                                                                    | D      | m                 |
| Ball screw length                                                                 | L      | m                 | Pinion thickness                                                                   | L      | m                 |
| Ball screw pitch                                                                  | P      | m                 | Pinion density                                                                     | $\rho$ | kg/m <sup>3</sup> |
| Ball screw density                                                                | $\rho$ | kg/m <sup>3</sup> | Friction coefficient                                                               | $\mu$  |                   |
| Friction coefficient                                                              | $\mu$  |                   | Gear ratio *                                                                       | G      |                   |
| Gear ratio *                                                                      | G      |                   | Mechanical efficiency                                                              | $\eta$ |                   |
| Mechanical efficiency                                                             | $\eta$ |                   |                                                                                    |        |                   |

| Belt drive                                                                         |        |                   | Roll feed                                                                           |        |                   |
|------------------------------------------------------------------------------------|--------|-------------------|-------------------------------------------------------------------------------------|--------|-------------------|
|  |        |                   |  |        |                   |
| External force                                                                     | F      | N                 | Sheet tension                                                                       | F      | N                 |
| Workpiece mass + belt mass                                                         | W      | kg                | Roll diameter                                                                       | D      | m                 |
| Pulley diameter                                                                    | D      | m                 | Roll width                                                                          | L      | m                 |
| Pulley width                                                                       | L      | m                 | Roll density                                                                        | $\rho$ | kg/m <sup>3</sup> |
| Pulley density                                                                     | $\rho$ | kg/m <sup>3</sup> | Roll moment of inertia J                                                            |        | kg·m <sup>2</sup> |
| Pulley moment of inertia                                                           | J      | kg·m <sup>2</sup> | Gear ratio *                                                                        | G      |                   |
| Gear ratio *                                                                       | G      |                   | Mechanical efficiency                                                               | $\eta$ |                   |
| Mechanical efficiency                                                              | $\eta$ |                   |                                                                                     |        |                   |

| Rotary indexing table                                                               |        |                   |
|-------------------------------------------------------------------------------------|--------|-------------------|
|  |        |                   |
| Table mass                                                                          | W      | kg                |
| Table diameter                                                                      | Dt     | m                 |
| Table support diameter                                                              | Dh     | m                 |
| Table moment of inertia                                                             | J      | kg·m <sup>2</sup> |
| Friction coefficient of table support                                               | $\mu$  |                   |
| Gear ratio *                                                                        | G      |                   |
| Mechanical efficiency                                                               | $\eta$ |                   |

\* Calculation of gear ratio (G)



$$G = \frac{\text{Number of screw threads (G2)}}{\text{Number of motor gear teeth (G1)}}$$





## ■ ECO PRODUCTS

SANYO DENKI's ECO PRODUCTS are designed with the concept of lessening impact on the environment in the process from product development to waste. The product units and packaging materials are designed for reduced environmental impact. We have established our own assessment criteria on the environmental impacts applicable to all processes, ranging from design to manufacture. Those products that satisfy the criteria are accredited as ECO PRODUCTS.

### Notes Before Purchase

- Read the accompanying Instruction Manual carefully prior to using the product.
- Do not use this product in an environment where vibration is present, such as in moving vehicles or shipping vessels.
- Do not modify or alter the product in any way.

Please contact us beforehand if you intend to use this product in the following applications.

- Medical equipment that may have an effect on human life
- Systems or equipment that may have a major impact on society or on the public
- Special applications related to aviation and space, nuclear power, electric power, submarine repeaters, etc.